SCIENTIFIC AMERICAN

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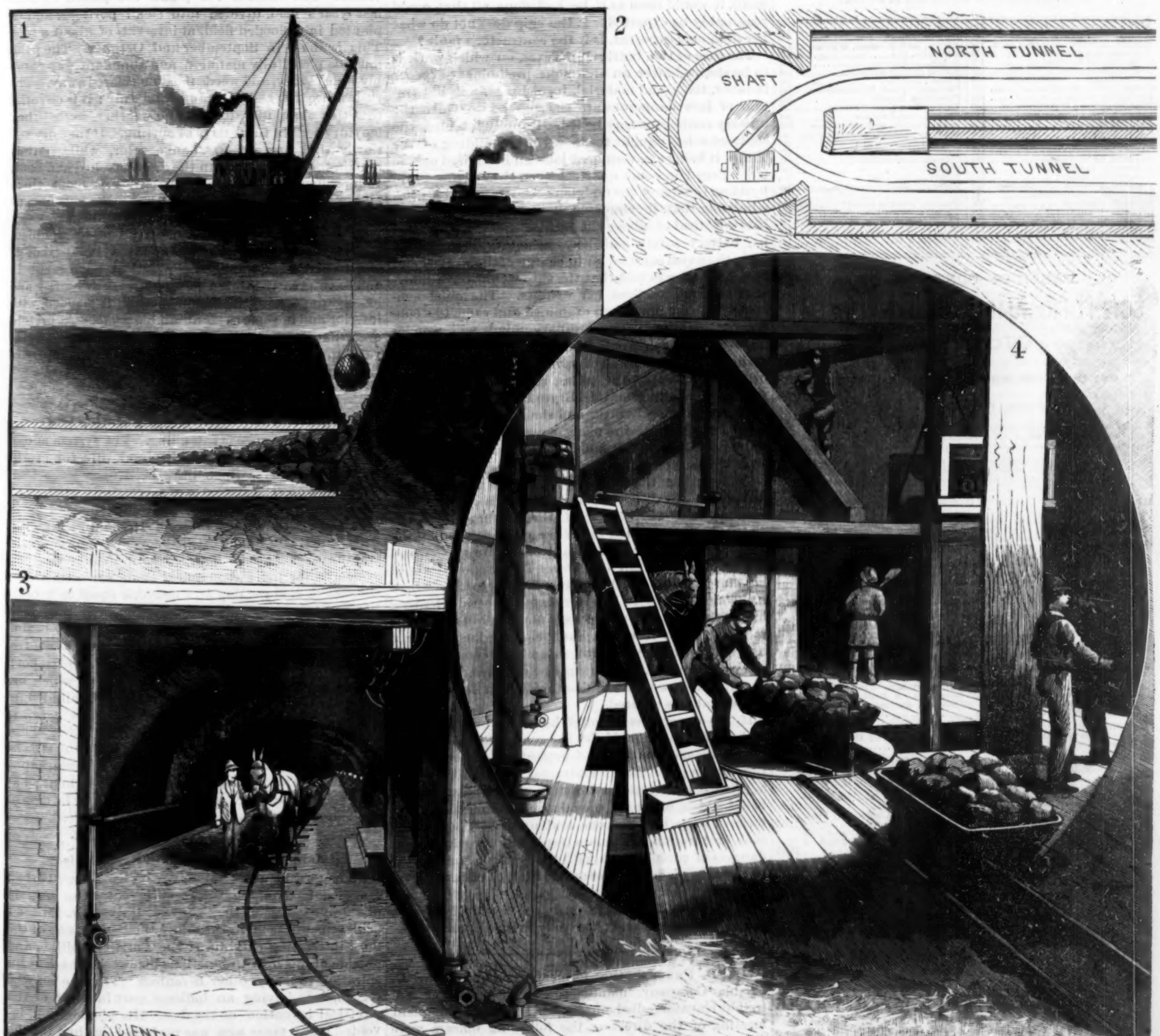
THE HUDSON RIVER TUNNEL.

The Hudson River tunnel, designed to give passage for railway trains under the wide body of water that separates New York from Jersey City, is again in process of construction. Some twenty years have elapsed since it was proposed in its present shape by the eminent engineer Mr. D. C. Haskin. It is the property of the Hudson Tunnel Railroad Company, a corporation organized under general laws of the States of New Jersey and New York, but which laws were passed for its benefit. It has a capital stock and has issued bonds to the amount of ten millions of dollars each. Were it now completed, there would be some 300 trains each way that would pass through it every day. For telegraph cables, pneumatic tubes, and similar purposes, its uses would be of considerable extent. The construction of other tunnels to the north and south of the present work is in contemplation also.

A year was occupied in taking a most exhaustive series of borings all along the proposed line of the tunnel across the Hudson River. These determined the fact that a bed of silt, admirably adapted for the work, extended most of the distance. In November, 1874, active work began on the New Jersey shore, under the general railroad laws. A month later an injunction arrested its progress, and for nearly five years nothing was done. It was in this interval that the passage of the special laws alluded to was obtained. Work began again in September, 1879, and all went smoothly forward. In the SCIENTIFIC AMERICAN of May 8, 1880, will be found an illustrated article on the operations of that early period. On July 21, 1880, an accident happened, in which twenty men were shut up in the tunnel and perished, the tunnel being flooded with water and partly collapsed. This occasioned more delay, which was to be regretted, independent of the dreadful loss of life and the popular stigma which it tended to place upon the tunnel. With much difficulty the damage was repaired and the bodies of the unfortunate men were recovered. Again, on November 4, 1882, work was stopped on account of the fatal illness of the president of the company, Mr. T. W. Park, and was not resumed for want of money. Up to this time about $1,050,000 had been expended, not counting interest or private expenditures of the originator of the tunnel, Mr. D. C. Haskin. Recently new capital has been subscribed, largely by English capitalists. Within the last few months the tunnel has been pumped out and work recommenced. Three weeks of regular construction have advanced the north tunnel nearly fifty feet beyond the point reached in 1882.

The tunnel is built under the plans of Mr. D. C. Haskin. Vertical shafts were sunk near the shores of the river. The one on the west shore is sixty-five feet deep, circular in section, and thirty feet in internal diameter. The walls lining it are four feet in thickness. From these as starting points two tunnels commence, diverging slightly and coming later into parallelism with each other. Each tunnel is lined with a shell of steel, built up of plates secured at the joints by angle irons projecting inward. The steel is three-sixteenths thick

(*Continued on page* 151.)



1. Closing hole in tunnel. 2. Plan of shaft and tunnel openings. 3. View at foot of west shaft. 4. The tunnel heading.

THE HUDSON RIVER TUNNEL AND THE WORK IN PROGRESS UPON IT.

Scientific American.

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Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 714.

For the Week Ending September 7, 1889.

Price 10 cents. For sale by all newsdealers.

GOVERNMENT CONTRACTS UNDESIRABLE.

The inclination to quote higher than market prices to the government that has recently been evinced by contractors for iron ship construction, though apparently unjustifiable, has, in reality, much to excuse it. Even in the recent case, where there were only two bidders, and their quotations so manifestly exorbitant as, perhaps, to warrant the press' suspicion of collusion and force the secretary of the navy to advertise again, we say even in this instance there is reason to believe that the bidders were sincere, did not communicate together, but, on the contrary, had, each in his calculation, added a percentage over and above a fairly profitable figure because the contract was to be with the government, and hence "extra hazardous." The reason for this is not far to seek. Against the government's ruling as delivered by a secretary of the navy there is no practicable appeal. We have seen in the case of the late Mr. Roach how recklessly, how pitilessly the power of the government may be used by ignorance or partisanship. We have seen how a contractor may be sentenced to ruin long in advance of the trial that proves him innocent, his work according to agreement.

Not even the *visé* and acceptance by a special board of officers appointed to oversee and pass upon contract work seems to be sufficient to insure prompt payment. At least it did not prove to be so in a notable and not very remote case. Experts were found to characterize as "structurally weak" a vessel which, when thoroughly tried, was found to be structurally strong. This same vessel (the Dolphin) left Plymouth, England, last week, bound hence, having been on a cruise extending nearly around the world. Given a series of specifications including amount, quality, and form of material, form of construction, and time to be consumed, if the contractor fulfills the conditions to the satisfaction of the inspectors appointed by the government, it would seem as if he had done all that could reasonably be expected. If the ship does not do what her designers expected, is it the contractor's fault?

The case of the battle-ship Texas, on which work is to be stopped after an enormous preliminary expense in labor, tools, and material, furnishes an apt illustration of how dangerous are the snares into which the unwary contractor may be led. Happily for him, the contractor has naught to do with the building of the Texas, it being a government job—an ill advised one, so it is alleged in some quarters, even the Barrow Shipbuilding Company, the designers, who were paid $21,500, admitting that, if completed, her armor belt would be below instead of above the surface, and the weight of her battery surely sink her. Secretary Tracy called upon the naval constructor in charge of the work for an opinion, and was told that the ship would have buoyancy enough to float her weights. The chief constructor of the navy then examined and came to a contrary conclusion. The ordinary mind will wonder why the chief constructor did not make the discovery earlier. The committee of naval and civil experts, who originally accepted the plans, re-examined and confirmed their finding, and Mr. Bryce Douglass, the builder of the Cunarder Etruria and similar ships, being employed to go over the plans, concluded that the ship must have 15 or 20 feet added to her length. Thus we have the authorities at loggerheads.

To lengthen the ship as proposed will necessitate alterations in all the plans, and, as is immediately obvious, increase the cost of the ship far above the $2,500,000 appropriated under the act of August 3, 1886. Now, if a contactor should have been doing this work, he would be between two fires. To abandon it would get him in trouble with the iron and steel works which had contracted with him for material, besides leaving him with a vast amount of tools and machinery; while to go on with it would, likely enough, land him in a law suit with the government, as represented by the navy department, which might be unwilling to pay for a ship that would not float, although it was such a one that was ordered.

If the government would have its work done well and cheaply, it should offer the contractor, if he prove faithful, some guarantee of protection. The assumption that a government contractor is more likely than a private contractor to take an unfair advantage, a belief which, of course, prevails only among the misinformed, is both dangerous and unjust. The fear of such accusation, but more especially the imminent dangers of complication with the government, has led to the condition now presenting itself of only two contractors in the whole country found willing to undertake contracts with the government on the ships most recently designed, and these only at exorbitant rates.

MR. D. FRISBIE, the former president of the D. Frisbie Company, manufacturers of passenger and freight elevators, died on August 1. At a subsequent meeting of the directors the following officers were elected: J. B. Scranton, president; C. F. Root, vice president; W. M. Frisbie, secretary; S. H. Barnum, treasurer. The works of the company are at New Haven, Conn., with a New York office at No. 112 Liberty Street.

A Terrible Weapon.

A series of experiments have just taken place in England in connection with the 36 pounder quick-firing gun. The experiments were to determine (1) the velocity of the armor-piercing shell at different ranges which would enable it to penetrate armor plating; (2) to determine at what angle to the line of fire one armor plate will keep out the 36 pounder armor-piercing shell; (3) to determine the thickness of plate which will keep out a common steel shell fired direct with a full charge of powder. The results were that at 2,600 yards the armor-piercing shell, with a velocity of 1,076 ft. per second, penetrated a plate of mild steel 3 in. thick. At 1,000 yards range, with 1,537 ft. velocity, it penetrated a 4 in. plate of hard steel, and a 5 in. hard steel plate was penetrated at 500 yards range with 1,748 ft. velocity. In the second experiment it was found that the shell penetrated a 3 in. mild steel plate at an angle of 35 deg., or 55 deg. to the normal. Against a hard steel plate of the same thickness the shell broke up at an angle of 30 deg. At a 4 in. hard steel plate the shell glanced off at an angle of 30 deg., while at 45 deg. the plate broke up, as did also a 5 in. plate when fired at from the same angle. In the third trial it was found that a 36 pounder common shell, fired direct with a full charge, was able to penetrate a 3 in. mild steel plate, but failed against a 4 in. plate.

Chinese Rush Goods.

The city of Ningpo is the center of the large internal and foreign trade in rush goods, such as hats, matting, etc. The magnitude of the trade may be estimated from the fact that last year 14¼ million hats, one and a quarter million mats, and about 8,000 rolls of matting were exported. The commissioner of customs in his last report from Ningpo describes the method of cultivation. The roots of the plants are pulled up from last year's field, divided into small portions, and replanted in a flooded field, at intervals of about a foot. This is done in September and October. The fields must be plentifully manured, and abundant water supply is necessary, and weeds must be cleared away. The rushes are harvested in June and July; it is essential that this should be done in fine weather, so that they may dry within three days of cutting. If they dry too slowly they are apt to change color, while if they remain too long in the sun they get scorched and bent. Rain, when they are only partially dry, spoils them altogether. An average worker can make four hats of good quality, 12 in., 3 braid, a day; working carelessly and weaving loosely, the quantity can be doubled. But in the rush trade, as in the straw braid trade of Northern China, fraudulent practices have crept in and have greatly injured it. The work is hastily and loosely done, and the home market is flooded with inferior and in some cases unsalable goods. At present every hat in every bale has to be examined, and every yard in every roll of matting, greatly to the injury of the trade.

Compressed Air as Motive Power.

The use of compressed air as a motive power for tramways in France is extending. The system adopted is that invented by M. Mekarski, director of the Nantes tramways, which have been open since 1879. Two years ago the system was successfully applied on the tramways at Nogent, in the neighborhood of Paris, and more recently on those of Berne and Limoges. This year it will be substituted for horse power on the tramways of Lyons. The inventor asserts that his system is far more economical than horse traction—the cost of coal per day of a machine equal to 8 or 10 horse power being only 4s.—much cheaper than electricity or steam power, and that the machinery is simple and does not require a skilled mechanic to control it. The British consul at Nantes, in a recent report, states that "the tramways of that town, which are worked by the system of M. Mekarski, alluded to above, continue to give satisfaction. The cars are comfortable and run smoothly with little noise. They do not interfere with the general traffic in the streets, and their immunity from accidents is remarkable. The average speed is about eight miles per hour; but it can easily be increased or moderated, and in case of need an almost instantaneous stoppage effected."

Honors Conferred on Thos. A. Edison.

On August 19, a special envoy of King Humbert of Italy conferred upon the great inventor the insignia of a grand officer of the Crown of Italy. Mr. Edison's achievements as an inventor are the basis of one of the most interesting exhibits at the Paris exposition, and outside of his own productions his work has lent inspiration to many other inventors. Thus he may be regarded as having an indirect part in much of the electrical invention of the day. His phonograph, invented many years ago, was perfected in time for the exposition, and for the past six months has given him new fame in Europe.

The honor awarded him by King Humbert is well deserved; his reputation before the world is and will remain his greatest honor.

Light in the Sickroom.

Still a custom prevails, despite all our sanitary teachings, that the occupant of the sickroom in the private house should be kept at all hours in a darkened room. Not one time in ten do we enter a sickroom in the daytime to find it blessed with the light of the sun. Almost invariably, before we can get a look at the face of the patient, we are obliged to request that the blinds may be drawn up, in order that the rays of a much greater healer than the most able physician can ever hope to be may be admitted. Too often the compliance with this request reveals a condition of room which, in a state of darkness, is almost inevitably one of disorder everywhere; foods, medicines, furniture, bedding misplaced; dust and stray leavings in all directions.

In brief, there is nothing so bad as a dark sickroom; it is as if the attendants were anticipating the death of the patient; and, if the reason for it be asked, the answer is as inconsistent as the act. The reason usually offered is that the patient cannot bear the light; as though the light could not be cut off from the patient by a curtain or screen, and as though to darken one part of the room it were necessary to darken the whole of it. The real reason is an old superstitious practice, which once prevailed so intensely that the sick, suffering from the most terrible diseases, smallpox, for instance, were shut up in darkness, their beds surrounded with red curtains, during the whole of their illness. The red curtains are now pretty nearly given up, but the darkness is still accredited with some mysterious curative virtue.

A more injurious practice really could not be maintained than that of darkness in the sickroom. It is not only that dirt and disorder are results of darkness, a great remedy is lost. Sunlight is the remedy lost, and the loss is momentous. Sunlight diffused through a room warms and clarifies the air. It has a direct influence on the minute organic poisons, a distinctive influence which is most precious, and it has a cheerful effect upon the mind. The sick should never be gloomy, and in the presence of the light the shadows of gloom fly away. Happily the hospital ward, notwithstanding its many defects, and it has many, is so far favored that it is blessed with the light of the sun, whenever the sun shines. In private practice the same remedy ought to be extended to the patients of the household, and the first words of the physician or surgeon on entering the dark sickroom should be the dying words of Goethe, "More light, more light!"—*B. W. Richardson, M.D.*

The "Amines" Process of Sewage Purification.

The purification and utilization of sewage, which has been essayed with more or less success by many inventors, forms a subject the universal importance of which can scarcely be overestimated. It is but too well known that all impure liquids, whether they be sewage or other foul or waste waters, or the waste effluents from chemical and other factories, contain, partly in suspension and partly in solution, substances the extraction or elimination of which is either desirable from a commercial or necessary from a sanitary point of view, or both. The separation of the suspended matters can be accomplished mechanically either by collecting the liquid in tanks and allowing sufficient time for subsidence of the solids or by filtering it through suitable mediums. If the specific gravity of the suspended solids is so nearly equal to that of the liquid in which they are contained that subsidence is too slow, the latter can be accelerated by adding to the liquid, and thoroughly intermixing with it, one of the several well-known substances which have long been successfully employed for such purposes, as, for instance, lime or sulphate of alumina.

This procedure is known as precipitation, and may be due, according to the material employed, either to mere mechanical action, or to chemical action, or to both mechanical and chemical action combined. As to the extraction or elimination of those valuable or deleterious matters which are not merely suspended, but dissolved in the liquid, it is now generally conceded that no known precipitation process succeeds in removing more than a limited portion of the same. Thus the effluent from every known precipitation process carries with it much that is valuable from a commercial and also much that is objectionable from a sanitary point of view.

Scientists, political economists, and sanitarians have long been engaged in finding a method of utilizing the valuable matters and of arresting or rendering innocuous the deleterious substances of sewage. Their researches have led to a large number of discoveries and inventions, but only a few of the latter have been put to a practical test, and the most that can be said of them is contained in the report of the late Royal Commission on Metropolitan Sewage Discharge (Lord Bramwell's), which ends by giving it as the judgment of the commissioners that "no known process of precipitation purifies sufficiently." Since that time (1884) we have had brought to our notice several methods of dealing with sewage, each claiming superiority over its rival. The latest of these is the "amines" process of sewage purification and utilization, which is now being experimentally tried at Wimbledon Sewage Farm, and which we there saw in operation. From observations then made, the conclusion arrived at is that the new process, which is the invention of Mr. Hugo Wollheim, is deserving of a prominent place, and is well worthy the serious attention of sanitary authorities. The "amines" process, so named because it utilizes certain organic bases belonging to the chemical group of amines (ammonia compounds), has for its objects—(1) the abolition of the pollution of rivers by sewage, etc., and (2) the recovery and utilization of the valuable constituents of the same. The *modus operandi* as now carried on at Wimbledon is as follows. The amines are used either pure or in the form of amine salts or in one of the numerous substances containing them, which occur in nature as well as in various waste products. Such amine or substances containing the same is used in combination with lime, preferably milk of lime. The proportions vary in accordance with the nature of the sewage and with the attending conditions. At present herring brine is the most abundant and convenient and at the same time cheapest substance which contains the amines. It is amply procurable from various localities at a nominal price. This brine is introduced into freshly made milk of lime of the consistency of a thin cream. It is immediately decomposed, and a very soluble new gaseous reagent is evolved, to which the inventor has given the name of "aminol." It announces itself by a peculiar briny odor, similar to that of the sea breeze. This regeant is a very powerful disinfectant. When introduced into sewage, it extirpates rapidly all micro-organisms capable of causing putrefaction or disease.

The disinfectant mixture is added to the sewage as issuing from the sewers, and is thoroughly intermixed with the sewage by ordinary mechanical appliances. The effect is almost instantaneous. By the action of the lime, violent flocculation is set up, and the suspended matters tend to subside. Simultaneously, the putrid smell of the sewage is replaced by the peculiar briny odor of the reagent. In this state the sewage flows into settling tanks. There the subsidence of the solids takes place at a rapid rate. When it is complete (in a depth of six feet it takes only half an hour), the brilliantly clear and bright supernatant liquid (effluent), completely deodorized and disinfected, may be discharged with perfect safety. To fish life it is innocuous when diluted with more than ten times its volume of water; but it contains in solution fertilizing principles, and it may, therefore, be advantageously applied to irrigation. The precipitate (sludge) remaining at the bottom of the tanks is also of the same briny odor as the effluent, and free from any tendency to putrefaction. It may, consequently, be left exposed without the least risk of nuisance, for any length of time, even in midsummer. It is brownish yellow in color, and lacks entirely the slimy appearance of ordinary sludge. Its quantity does not exceed that resulting from other treatments. The manurial value of the sludge is stated to be somewhat above that of the best farmyard manure. When the fresh sludge resulting from the first treatment is fortified by the addition of about one-fifth of the quantity of disinfecting mixture originally used, another volume of sewage equal to the first will be treated by it with like effect, and the same operation may be performed a third time after the effluent from the second has been drawn off. This feature reduces the final cost to nearly one-half of what it would otherwise be. The uses to which the sludge may be finally put are many. When taken from the tanks, it contains over 90 per cent. of moisture. After draining it of a large portion of the same in special settling tanks, it will be available for filling up low-lying lands. If it is to be used as manure, it is reduced in filter presses to solid cake; but it can be still further reduced in bulk and weight by air-drying and crushing to a fine powder.

There are other valuable principles besides the manurial contained in the cake and also in the powder. It is believed, from experiments now in progress, that means will soon be found for extracting and utilizing the same with a fair margin of profit. The cost of the process as regards materials used naturally varies with the conditions and requirements in each particular case. In round figures it may be stated to be from ½d. to ¾d. per 1,000 gallons treated. In the case of the London sewage (taking the daily flow as 130,000,000 gallons) the cost need not exceed £330 daily, equal to about £125,000 annually, which means 7½d. per head of population, or a rate below 1d. in the pound. It may here be added that the Royal Commission on the Metropolitan Sewage Discharge states in its final report: "We may fairly conclude that the cost of treating the sewage of London by a good and efficient chemical precipitation process would entail an expenditure of not less than £200,000 a year." The sludge cake from the London sewage would amount to about 500 tons daily. The cost of pressing is about 2s. 6d. per ton. Every shilling above this cost of pressing realized for the cake means a reduction of £25 off the above estimate of £330 daily. The chances for the springing up of a demand for a portion at least of London sludge and for a gradual and steady increase of the same would be certainly much better in the case of a sludge such as the "amines" process produces.

There are further savings indicated (in time, tank space, labor, and plant) by certain important features of the process, such as the rapidity of subsidence and the repetition treatment; but upon these we need not further dilate. We may, however, refer to the important reports upon the process made by Dr. E. Klein, F.R.S., with the object of ascertaining whether the treatment of sewage by the process succeeds—as the inventor claims it does—in producing a sterile effluent. The first of these reports is upon the bacteriological and microscopical investigation of the results of experiments made with the "amines" process at the Canning Town Sewage Works, West Ham, on January 26 and 29 last, when Dr. Klein found that, while 1 cubic centimeter of the original sewage contained 2,400,000 organisms, the resultant effluent, after treatment with the process, was absolutely free from all or any organisms, and would, therefore, on its discharge into a river, cause no increase of the microbes already present in such river. In his second report, upon his investigations on the treatment of the sewage at Wimbledon, Dr. Klein, in dealing with the effluent, states:

"This (the effluent) had also been divided into two parts, one of which was kept in the glass-stoppered bottle, the other transferred to a bottle plugged only with sterile cotton wool. Both divisions were subjected to three consecutive tests by gelatine plates, viz., after 24 hours, after 3 days, and after 6 days. Every one of these plates showed an entire absence of microbes. The effluent must, therefore, be pronounced to be sterile. These tests confirm, in a marked degree, the results of my previous investigations on this point made last February on the effluent from the experiments with the Canning town sewage. On the other hand, as to the effect of treatment with lime only, the tests made with it at my laboratory demonstrated that it is not capable of producing the same effect.

"In conclusion, I would say that the powerful antiseptic and disinfectant properties of your treatment, as shown by its effect upon the organisms present in sewage, lead me to suggest the importance of carrying the investigation a step further, viz., to determine its effect on specific micro-organisms, such as, for instance, bacillus anthracis, the cholera comma bacillus, the typhoid bacillus, the pneumonia bacillus, and others."—*Iron.*

The Scripps League in England.

Among the American workingmen's expedition sent to this country by a syndicate of American newspapers, called the Scripps League, no fewer than sixteen of the deputation represent various branches of the iron and metal trades, and one coal mining, in the United States. The expedition is accompanied by a staff of newspaper correspondents, among whom one is the son of Nathaniel Hawthorne, the American author, an artist, a photographer, a courier and interpreter, and an advance agent. There are also among the deputation four American ladies representing women's work of various kinds. The members of this deputation are visiting the various industrial centers of England, and are inspecting the more important works. All branches of engineering establishments and iron and brass foundries are being inspected, and the men take care to make themselves acquainted with the social condition of the people in the towns they visit. It appears, from a casual observation dropped at the dinner at the Tavistock Hotel, that the Americans think that their output per man is greater than in this country, generally speaking. The female portion of the expedition was much shocked by their visit to the chainmaking districts of Staffordshire. They had no conception of the kind of work performed by the women in that part of England. The officers of the various trade unions in the iron trades have been devoting some time to the members of the deputation.—*London Engineering.*

Mussel Poisoning.

The occasional occurrence of poisoning through the eating of mussels forms the subject of an official report by the Consultative Committee for Sea Fisheries in France (*Nature*, June 20, p. 178). Various explanations as to the cause of the occasional toxic action were investigated by the committee, among them a suggestion that it is due to a parasite crab (*Pinnotheres pisum*); but this was dismissed, as the same crab is said to be sought after in the United States as an article of food. Other suggestions that it is due to the spawn of star fish, or to copper absorbed from the water, as well as the radical one that the symptoms observed have been simply the work of the imagination, were considered to be disproved. The committee came to the conclusion that the poisonous action of mussels is due to the presence, especially in the liver of the fish, of an organic base, the mytilotoxine of Brieger, and that this is developed under the influence of a particular microbe occurring only in mussels that have lived in stagnant or polluted water. It is stated that such mussels are deprived of their poisonous property by the addition of sodium carbonate to the water in which they are boiled.

ELIAS LOOMIS.

Cleveland Abbe once wrote that: "As a science of observation, generalization, and induction, our present knowledge of meteorology dates from Aristotle; but as a deductive science, and one deserving to be ranked with astronomy, chemistry, and physics, its history is confined to the past twenty-five years." The early history of any science cannot be traced with exactness, but beyond doubt among the pioneers in the study of meteorology, especially as applied to this country, the name of the distinguished scientist that stands at the head of this column must ever be classed.

Elias Loomis was born in Willington, Conn., on August 7, 1811. He was fitted for Yale by his father and entered the freshman class in 1826, graduating four years later. Soon after he was appointed a tutor at Yale, and during 1833-36 he held that place. In 1836 he went to Paris, where he spent a year attending the lectures of Arago, Biot, Dulong, Poisson, Pouillet, and others. On his return in 1837 he entered upon the duties of the chair of mathematics and natural philosophy in Western Reserve College, in Ohio, where he remained until 1844. Meanwhile he was diligently engaged making various observations with the apparatus that he had purchased in Paris for that institution.

Professor Loomis then accepted the chair of natural philosophy at the University of the City of New York, which he held until 1860, when he returned to his *alma mater* as Munson professor of natural philosophy and astronomy. This last appointment he continued to hold until his death; although for several years past his failing health prevented him from delivering all the lectures of his course, still he was unwilling to retire from the faculty, and provided a substitute when he was unable to appear.

His scientific work began almost as soon as he left college, and during November and December, 1834, for two weeks, from 4 to 6 A. M., with Professor Alexander C. Twining, of West Point, N. Y., he made observations for determining the altitude of shooting stars. "These," he himself writes, "are believed to have been the first concerted observations of the kind made in America." For fourteen months in 1834 and 1835 from about 6 o'clock in the morning until 10 at night he made hourly observations of the declination of the magnetic needle. He was the first person on this side of the Atlantic to discover Halley's comet on its return to perihelion in 1835, and he computed the elements of its orbit from his own observations.

During his connection with Western Reserve College he observed two hundred and sixty moon culminations for longitude, sixty-nine culminations of Polaris for latitude, sixteen occultations of stars, and he made a series of observations upon five comets, sufficiently extended to determine their orbits. He also observed the dip of the magnetic needle at over seventy stations spread over thirteen States, extending from the Atlantic Ocean to the Mississippi River.

During the years 1846-49 Professor Loomis was for several months employed in telegraphic comparisons for longitude in concert with Sears C. Walker. The difference of longitude between New York and Cambridge, Mass., in 1848, and that between Philadelphia and the observatory at Hudson, Ohio, was determined in 1849. In the two former comparisons Professor Loomis had charge of the observations at New York, and in the latter comparison he had charge of the observations at Hudson. The first observations by which the velocity of the electric fluid on telegraph wires was determined were made January 23, 1849, between Washington, Philadelphia, New York, and Cambridge, under the direction of Sears C. Walker, a clock in Philadelphia being employed to break the electric circuit. In these comparisons Professor Loomis had charge of the observations at New York.

After settling in New Haven he gave lectures on meteorology, and in July, 1874, published in the *American Journal of Science* the first of a series of papers entitled "Contributions to Meteorology." These he continued to prepare until they were twenty-two in number, when he undertook their revision, and the leisure of his last years was spent in arranging the topics in systematic order and at the same time subjecting each principle to a more rigid investigation by comparison with the numerous observations that have recently been published in the United States and elsewhere. These revised contributions, when completed, will present a very full discussion of the principles of dynamic meteorology, and it is to be hoped that his work on them had progressed sufficiently to permit of their publication.

Professor Loomis' scientific papers exceed one hundred in number, filling more than twelve hundred pages. These have appeared in the "Transactions" of the American Philosophical Society and of the Connecticut Academy, in the publications of the Smithsonian Institution, the *American Journal of Science*, the "Proceedings of the American Association for the Advancement of Science," in Professor Benjamin A. Gould's *Astronomical Journal*, and similar publications. Many of his papers were reprinted *in extenso* in such European periodicals as Sturgeon's "Annals of Electricity," the *Edinburgh*, now *Philosophical Journal*, the *Bibliotheque Universelle de Geneve*, *Poggendorff's Annalen*, and others. The first issue of his "Contributions to Meteorology" was translated into French, and also a very full synopsis of these papers was published in the Italian language at Rome.

During the sixteen years that he was connected with the University of the City of New York he was engaged in the preparation of a series of text books, embracing the entire range of mathematical subjects usually taught in high schools and colleges. These included "Plane and Spherical Trigonometry" (New York, 1848); "Progress of Astronomy" (1850 and 1856); "Analytical Geometry and Calculus" and "Elements of Algebra" (1851); "Elements of Geometry and Conic Sections (1851 and 1871); "Tables of Logarithms" (1855); "Natural Philosophy" (1858); "Practical Astronomy" (1855 and 1865), to which must be added his "Elements of Arithmetic" (1863), "Treatise on Meteorology" (1868) and "Elements of Astronomy," that were published after his return to New Haven. His treatise on "Practical Astronomy" received high commendation from the leading astronomers of Great Britain, and was used as a text book in that country. His "Treatises on Analytical Geometry and the Calculus" were translated into the Chinese language, and his "Treatise on Meteorology" was translated into Arabic. In all, his text books attained a circulation of more than five hundred thousand copies. Besides these, he published "On Certain Storms in Europe and America" (Washington, 1860), forming part of one of the Smithsonian contributions, and a genealogical work entitled "The Descendants of Joseph Loomis" (New York, 1870). His entire publications were estimated by himself to amount to about eight thousand pages.

ELIAS LOOMIS.

In 1854 the degree of LL.D. was conferred upon him by the University of the City of New York. He was a member of many scientific societies, of which the more important were the American Philosophical Society (1839); the American Association for the Advancement of Science (1848); the American Academy of Arts and Sciences (1850); corresponding member of the British Association for the Advancement of Science (1857); honorary member of the Philosophical Society of Glasgow, Scotland (1860); the Natural Academy of Sciences (1873); honorary member of the Royal Meteorological Society of London (1874); honorary member of the Royal Irish Academy (1880); and the Societa Meteorologica Italiana (1883).

Since the death of his wife, some years ago, Professor Loomis has lived in seclusion. His immediate family consists of two sons, one of whom is at present traveling in Asia, and the other is a resident of California.

After the college commencement in July he went to Putnam, Conn., where he proposed to spend the summer, but his health failing him, for he had been a sufferer from Bright's disease, he returned to New Haven early in August and went at once to the hospital. From the carriage that brought him to the door he was taken to the cot from which he never rose. The physicians immediately decided his case fatal, but with wonderful vitality he clung to life, until, on the afternoon of August 14, he passed painlessly away.

His colleagues, Professor William H. Brewer and Professor Franklin B. Dexter, were both with him at the end and took charge of the funeral, which was held at Battell Chapel on August 19, when President Dwight, of Yale University, preached the funeral sermon.

M. B.

Norris Peters.

Inventors will doubtless be surprised to hear of the death of Norris Peters, whose name has appeared in fine print so regularly for a number of years on the picture portion of United States patents.

He was one of Washington's most eccentric and mysterious characters, and was widely known as the government photo-lithographer. The New York *Evening Post* says of him:

"He was the companion of some of the most prominent members in both branches of Congress, and was known to them as one of the most genial, kindly, and generous of men. Yet one of them says: 'I could not tell you whether he was worth one million dollars or one dollar.' Norris Peters came to Washington from Pennsylvania. He was an examiner in the Patent Office for some years. He developed a taste for photo-lithography, resigned his position in the government service, established a plant which is said to be without an equal in any country (worth at least $100,000), and by workmanship which no other competitor has ever been able to equal, secured, and retained for almost a generation, the contracts for illustrations and other reproductions for the Patent Office, the Coast Survey, the Government Printing Office, and for most of the costly illustrated work of the government. Rivals sometimes spoke of 'lobby influence;' but when the contract day came, it nearly always happened that Norris Peters was the lowest bidder. Sometimes his bids were so low that his competitors insisted that the work could not be done for the money; but it was done, and well done. Once or twice other parties underbid him, and the contract was awarded to firms in distant cities; but, in at least one of these instances, the government released itself in some way from the contract on the ground that the work was not well done, and requested Mr. Peters to assume his old place. He had a practical monopoly of the government work of this kind, and this monopoly was secured by low price and merit. Men in his profession who have endeavored to fathom the mysteries of his success insist that he had some secret process by which he was able to do so excellent work at so low prices. Certain it is that his establishment was closed to all comers. Very few persons were ever invited within the walls of the large building.

"There were many peculiar traits about this strange man. For some of the most distinguished men in Congress he seemed to possess a peculiar attraction. He gave several times each winter great dinners, prepared as to the minutest details under his personal direction. He was almost the successor of Sam Ward. His invitations were never declined. Roscoe Conkling was his friend. Senators Kenna and Blackburn and Secretary Windom were also. One of his most intimate acquaintances, a man of influence in public life, said recently that in all of his intercourse with him he never heard him refer to his private business or ask a favor of any sort. He was a bachelor and lived alone. He is supposed to have been worth about one million dollars. He was a man of great but unostentatious charity. The poor colored people of his aquaintance will greatly miss him.

"It has been suggested that the government should purchase his plant and undertake itself to do the work for which so large sums have been paid for the last twenty years."

The administrator of his estate, Henry V. Parsell, of this city, an amateur photographer, will continue to carry on the business.

ACCORDING to a recent geological survey, the Belle Vernon, Pa., gas field is twenty-two miles long and two miles wide. The first well put down was the Carson, which is now flowing 5,000,000 ft. every twenty-four hours. The next was the Parson well, which has a pressure of 100 pounds more than the Carson and is supplying Brownsville and intermediate points through a 5⅝ in. pipe and shows a pressure of 100 pounds at Brownsville. The Rider well came in soon after the Parson, and the combined amount of gas yielded by these three wells is 45,000,000 ft. per day.

The Allman well, put down by the Philadelphia company and reported at the time as the largest well ever struck, was the next one. The gauge of this well is put at 810 pounds. Drilling is going on in a number of places and with good prospects, only one dry hole having been drilled so far.

AN IMPROVED GAME APPARATUS.

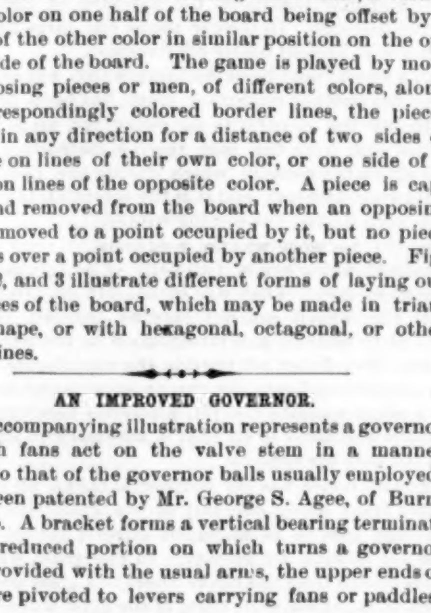
The accompanying illustration represents a game-board, with pieces or men to be used by one, two, three, or four persons, in playing a novel game styled "Brax," affording room for the exercise of considerable skill. The invention has been patented by Mr. Frederic B. Denham, of No. 744 Broadway, New York City, who also publishes the apparatus. The board has a series of adjoining square spaces, similar to those of a chess board, the margins of which are distinguishable by heavy and light lines, a distinction which will preferably be made by lines of the same thickness in different colors. These borders have three sides of each

DENHAM'S GAME OF "BRAX."

space in one color and the fourth side in another color, the two halves of the board being made alike, a border of one color on one half of the board being offset by a border of the other color in similar position on the opposite side of the board. The game is played by moving opposing pieces or men, of different colors, along the correspondingly colored border lines, the pieces moving in any direction for a distance of two sides of a square on lines of their own color, or one side of a square on lines of the opposite color. A piece is captured and removed from the board when an opposing piece is moved to a point occupied by it, but no piece can pass over a point occupied by another piece. Figures 1, 2, and 3 illustrate different forms of laying out the spaces of the board, which may be made in triangular shape, or with hexagonal, octagonal, or other border lines.

AN IMPROVED GOVERNOR.

The accompanying illustration represents a governor in which fans act on the valve stem in a manner similar to that of the governor balls usually employed. It has been patented by Mr. George S. Agee, of Burnham, Mo. A bracket forms a vertical bearing terminating in a reduced portion on which turns a governor frame provided with the usual arms, the upper ends of which are pivoted to levers carrying fans or paddles.



AGEE'S GOVERNOR.

The upper end of each lever has a slot in which fits a pin held on the outer forked ends of an arm mounted to turn in an annular recess of a head secured to the upper end of the valve stem, which has its bearing in the reduced portion of the vertical bearing of the bracket, and is connected at its lower end in the usual manner with the steam inlet valve. A spiral spring is coiled on the upper end of the valve stem, pressing against the head screwed thereon and upon a nut on the upper threaded portion of the vertical bearing of the bracket. Another nut holds the governor frame in place, and in the lower end of the frame is a bevel gear wheel meshing into a bevel gear wheel secured to one end of a shaft connected in the usual manner by a belt with the main driving shaft. The governor shaft rotates in bearings on a bracket fitted into a dovetail formed in the bracket supporting the governor, as shown, when the driving power is derived from a horizontal shaft, but when a vertical shaft is used the driving belt is passed over a pulley above the bevel gear wheel in the lower end of the governor frame. A lever is pivoted in the supporting bracket, and carries at its outer end a pulley which rides on the governor belt, this lever fitting into a lug formed on a collar secured to the valve stem, and closing the valve in case of the breaking of the governor belt. This device is designed to avoid all unnecessary friction or lost motion, and with increase of speed to effect a corresponding reduction of friction and inertia.

Yellow Pigment in Butterflies.

The color effects on the wings of lepidopterous insects are for the most part probably due to purely physical causes, but in some cases pigments are undoubtedly present. A yellow pigment, which is found in its purest form in the common English brimstone butterfly, and may also be detected in the wings of a very large number of day-flying lepidoptera, can be obtained from the wings by simple treatment with hot water, in which it is freely soluble, and may be identified by its yielding a marked murexide reaction, when evaporated with nitric acid, and afterward treated with ammonia or potash. The common brimstone butterfly yields somewhat less than a milligramme of pigment from each insect; larger foreign species, such as those belonging to the species *Callidryas*, may yield as much as 4 to 5 milligrammes. Examination of the pigment reveals its near relationship to mycomelic acid, a yellow derivative of uric acid; and the author suggests that it may possibly be a condensation product of uric and mycomelic acids.—*F. G. Hopkins.*

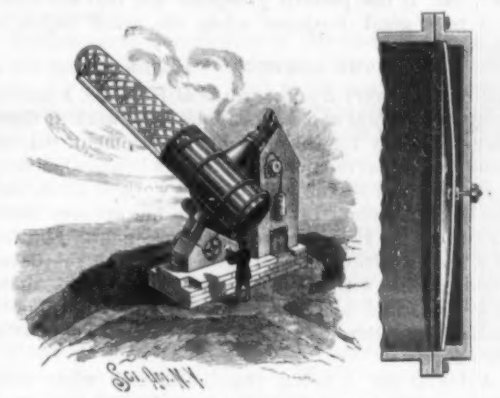
AN IMPROVED WINDOW VENTILATOR.

The accompanying illustration represents a ventilator especially designed for use in the windows of sick rooms, where it is desirable to use disinfectants or inhalents, and which is suitable for use in either summer or winter weather, as it does not subject the occupants of apartments so ventilated to objectionable air currents. The invention has been patented by Dr. Alfred C. Stevenson, of Oakdale Station, Pa. A spring roller is journaled in bearings in the top of the groove for the lower sash, as shown in the sectional view, this roller being provided with a curtain or diaphragm of firm cloth, such as canvas, sufficiently long to extend from ten to twelve inches from the top of the window. This diaphragm is wider than the roller, and has side hems which travel between metal guide strips. At its lower end the diaphragm is attached to a cross strip that slides over the beads of the upper sash, to which it is attached, so that when the upper sash is pulled down, the diaphragm unwinds from the roller and extends across the opening, where it is held taut by the spring of the roller, a set screw or clamp, if necessary, holding the sash down to its adjustment. There is a plate in the rear of the roller, and another plate adjusted to the top of the lower sash, so that no air can pass except through the diaphragm. Upon the inside of the window frame at the top are brackets in which is journaled another spring roller having a diaphragm of lighter fabric, such as muslin, which may be pulled down and held taut by hooks on the window frame. Between these two diaphragms, and detachably supported upon loops or brackets, is a rectangular frame, the edges of which are closely fitted against the two diaphragms to form a chamber for disinfectants or inhalents, placed there in wide-mouthed bottles or jars, as represented in the illustration, showing the appearance of the ventilator from the interior of the room. This space may also be utilized for a water trough to moisten the air of the room. It is said that this method of employing inhalents has proved of excellent service in practice in lung diseases, by the use of creosote and turpentine, affording complete relief of the constant headache which attended some of the cases, while for destroying the germs of disease in a sick room, without injury to the patient, it possesses many advantages. In warm weather the inner diaphragm need not be used.

SIXTY years ago railroads were unknown in this country, and the population of the United States consisted of 12,000,000 people. To-day we operate upward of 165,000 miles of railroad, and our population has increased to 60,000,000. Sixty years ago the aggregate wealth of the United States was less than $1,000,000,000; at present it is estimated at $56,000,000,000. Over our 165,000 miles of railroad there was carried last year 475,000,000 people, and 600,000,000 tons of freight were transported. Upon these lines are engaged 1,000,000 employes. Their equipment consists of 30,000 locomotives, 21,000 passenger cars, 7,000 baggage cars, and 1,000,000 freight cars. The capital invested in construction and equipment amounts to $8,000,000,000, and the yearly disbursements for labor and supplies exceed $600,000,000.

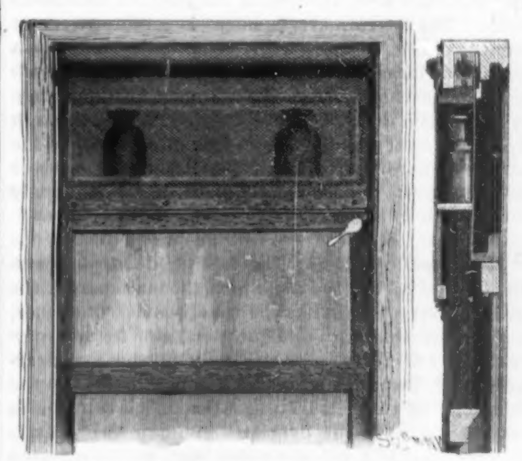
AN IMPROVED ASTRONOMICAL MIRROR.

A means whereby concave mirrors of long focus may be readily produced from plane-faced mirrors is illustrated herewith, and forms the subject of a patent



O'BRIEN'S ASTRONOMICAL MIRROR.

issued to Mr. Dennis O'Brien, of Oswayo, Pa. The mirrors to be formed must be of a parabolic section, a true parabolic mirror six feet in diameter and seventy-two feet focus having a central depression of just three-eighths of an inch. To make such a mirror a pan is employed, preferably made of cast metal to be extremely rigid, and with flanged edges by which it may be bolted by three equidistant bolts to the flanged end of the tube. This pan is formed with a seat or shoulder, as shown in the sectional view, upon which there is placed a plane mirror, through the axis of which there is drilled a small hole adapted to receive a tube, with threaded ends to engage an upper and a lower disk, fitting on the upper and lower faces of the mirror. The bottom of the pan has a central aperture through which is passed a headed and threaded tube



STEVENSON'S WINDOW VENTILATOR.

engaging the other tube, and the tube passing through the bottom is turned by means of a suitable wrench, to draw the center of the mirror down against its own rigidity, bending it into concave shape. It is estimated that the central disks need not be larger than half an inch in diameter for a six foot mirror, and this bending of the mirror is preferably done while the mirror is set facing a test object.

AN AUTOMATIC ASH SIFTER.

We republish herewith an illustration of an improved ash sifter which has been previously noticed. The lid was incorrectly drawn in the previous instance, and at the request of Messrs. Beck & Love, of No. 20 South Gay Street, Baltimore, Md., we give a view of the device as now manufactured, the cinders being dumped in at the front of the sifter to utilize the entire upper part of the sieve.

LOVE'S ASH SIFTER.

Railway Shop Notes.

In the railroad shops in the vicinity of St. Paul and Minneapolis business is very quiet at present. Many of the shops are running only eight or nine hours per day, but if the present prospects are realized there will be a good business when the grain begins to move.

THE NORTHERN PACIFIC

Railroad has very fine car works at Hamline, a station between St. Paul and Minneapolis. The work at these shops is mostly for the passenger equipment, though some freight car repairing is done. At Brainerd, Minn., a greater part of the freight car work is done, and the largest locomotive shops of the line are also there. The shops at Hamline are most excellent. Located in a good position, in well lighted and well ventilated buildings and with many conveniences, they are about as well adapted to their work as it seems possible to make them. Several cars of interest are at present in the shops.

A dining car is being remodeled, and when completed will be especially well adapted to the long runs between St. Paul and the Pacific coast. It has an extra large ice chest, and two smaller ones, the combined capacity of all three being considerably greater than is usually the case. There are two doors in the kitchen end of the car. The central door leads, as usual, to the passage which curves to the side of the car and which passes the kitchen and pantry and leads into the dining room. A second door at one side of the central door leads into the kitchen, a hinged platform over the steps on that side making a safe entrance. By this arrangement none of the odors from the kitchen find their way through the vestibule into the other cars. The floor of the kitchen is covered with sheet copper and the window sills are of such an inclination on the inside that moisture on the glass in cold weather will not remain in pools on the sills.

The Pullman Company have recently delivered to the road ten new vestibuled sleepers of handsome finish. The interior arrangement is an improvement over the more common cars. The ladies' toilet is a very much larger room than usual and has two wash bowls. The closet is separated from the toilet room by a door and can be entered only by passing through the toilet room. As there is no lock on the door of the latter it is hardly possible that ladies riding in these cars will have a chance to complain of the monopoly of their fellow travelers. The state room is double, that is, there are two rooms which can be used as one or separated by closing the folding doors between them. The part of the room next the main part of the car is in every respect like the usual room. The other, however, is smaller, but is quite suitable for two persons. The first section in the body of the car is arranged for draperies which will separate it from the remainder of the car. The gentlemen's lavatory is a decided improvement over the common form. It is not open, but is a private room next to the smoking room, and has a door opening into the side passage, and another into the smoking room. When desired the door between the rooms can be kept closed, but in the mornings the two rooms can be thrown into one. This is a much better arrangement than the open lavatories.

Each division superintendent on this road is supplied with a car in which he can go over his division inspecting, etc. It is plain, but neat and comfortable, is provided with an inspection room, a private state room, kitchen and pantry, and two sections somewhat similar to those in a sleeper.

The standard immigrant sleeping cars, several of which are at present in the shops, are all arranged so that the wash rooms, cook stove, etc., with the exception of the ladies' toilet, are separated from the body of the car by a transverse partition, in which is a swing door, thus keeping the main part of the car much warmer in winter, the passing in and out producing fewer cold draughts.

All passenger cars of every nature when in the shops for extensive repairs are being filled with a non-conducting material between the inner and outer sheathing. Felt is the material being used at present. This is done to protect them from the severe cold in this part of the country. The cleaning of all brass and bronze work, and all the nickel plating, is done at the shops. In cleaning, the work is dipped first in boiling potash to clear off oil and grease, then rinsed and then dipped in acid, and again in water. The saving of time by this method is very great. All sleeping cars are being fitted with vestibules as they come into the shops for repairs, and after that work is complete, it is the intention to also fit up the coaches in the same manner. At Brainerd freight cars are being equipped with an air brake at the rate of 12 per day. The road has now some thousands of cars so equipped.

Recently the first one of a recent order of eight heavy consolidation engines was delivered by the Baldwin Locomotive Works to the Northern Pacific Railroad. These engines have 22×28 inch cylinders, 50 inch wheels, 72 inch boilers, and weigh 150,000 pounds, 15,000 of which is on the truck and 135,000 on the drivers. There are 13 of these engines already at work on the mountain grades. The heaviest grade is about 13 miles long and 116 feet to the mile, and two of these engines, one at the head of the train and one in the middle, can take up about 34 loaded cars.

The shops of the

CHICAGO, ST. PAUL & KANSAS CITY

are at South Park, near St. Paul. No new work is supposed to be built here, but some extensive rebuilding is done at times. At present the engines used on the suburban traffic are too light for their work, and as eight-wheelers are hardly adapted to the work, Mr. Reid intends to alter some light 15×24 inch eight-wheeled engines into Forney's, retaining the leading truck. The engines will have a Forney tank, also a saddle tank over the boiler, and these tanks will be connected on each side so that they will be filled and emptied as one. This will give a capacity of 1,900 gallons of water and three tons of coal. A large eight-wheeler is about to undergo several alterations by which its wheel base will be altered and its boiler lowered.

Experiments have recently been made with various coals used by the road, and the best coals gave an evaporation of 6¾ pounds of water per pound of coal, while the poorest gave only 4¼ pounds.

The road has recently received five 18×24 inch eight-wheelers with 62 inch wheels, 54 inch boilers, 78 inch grates, with a weight of 98,500 pounds, 67,000 of which is on the drivers. The valve motion is special. It is a link motion, but the valve travel is 6¼ inches, and the outside lap 1¼ inches, the object of these proportions being to obtain a large port opening at early cut-offs. They have also received five 18×24 inch moguls, with 55 inch wheels, and 78,000 pounds on the drivers.

Car work is also done at these shops, but at present there is little of it under way. The buildings are well lighted, and the power is furnished by a number of Buckeye engines located in various parts of the works.

THE ST. PAUL, MINNEAPOLIS & MANITOBA

shops at St. Paul present quite a busy appearance at present. Every track on the erecting floor is occupied by an engine. There is, however, but little outside of the regular class of work. Quite a number of fine-looking moguls, with large, straight boilers, were to be seen in the roundhouse and shop. In the roundhouse there are a number of drop pits very conveniently located. The shops are run by a Wright engine, which is belted to the main line in the machine shop. From this shaft a cable passes into the wood-working shops, to drive the shafting there. The work that this cable does is so severe that steel wire would not answer the purpose, and a phosphor bronze cable is now used. This is found to last nearly twice as long as steel, and when finally it does give out, its value as scrap is great enough to balance the greater first cost. Many of the engines on this road have diamond stacks. Some engines, however, have recently been fitted with straight stacks, but without the extension.

AT THE CHICAGO, MILWAUKEE & ST. PAUL

shops, at Minneapolis, many engines are being overhauled and repaired. These shops are pretty large, and they have a great many engines and cars to care for; in fact, the rolling stock for the 3,000 miles of road is kept up at this point. On the erecting floor are abundant proofs of the bad work which poor water is doing on the boilers. Tubes and crown bars, as they come out of the boilers, are covered with a heavy coating of scale, and the sheets of the fire box have to be renewed very often. To remedy, if possible, some of the difficulties, the water spaces around the fire box are being increased by offsetting the sheets a short distance above the ring until the space is about 5 inches. Considerable attention is also being paid to combustion, and as the engines come into the shop, the fire boxes are being fitted with air tubes for the admission of air above the fire. The tubes are about 2 inches inside diameter, and two of these are placed in the front of the box and two on each side when the box is of ordinary length.

In the car shops the truck beams and other timbers of about that size are being covered with paint in a manner which saves time and also produces more thorough work. After the timbers are complete, bored and all ready for the car or truck, they are immersed in a tank of paint and then placed on an inclined platform, where all superfluous paint drips off and runs back into the tank. By this means more paint adheres to the wood and it penetrates all "checks" and coats the inner surface of bolt holes, mortises, etc.

A RAILWAY WEED CUTTER.

Experiments are being made with a weed cutter. A flat car has been fitted up for the purpose. On a transverse shaft between the trucks a drum about 14 inches in diameter and 8 feet long is mounted, and from this projects many small, flexible strips about 5 inches long, ½ inch wide, and as thin as possible. The height of this drum can be regulated by a lever and quadrant on the floor of the car. The drum is driven 1,000 revolutions per minute by a stationary engine located on the car and belted to it. Steam is supplied by a small boiler of the locomotive type placed beside the engine. With the drum revolving at 1,000 revolutions per minute the car can be run over the road at a speed of three or four miles per hour, and the weeds cut down to a level with the top of the ties. Such a machine effects a great saving of time and labor on many sections of the road.

About 350 engines and cars on this road are at present equipped with the Bristol automatic safety brake. This is a device for putting on the air brake automatically and instantaneously if the car is derailed or meets a dangerous obstruction. The car shops are piped, so that all air brakes can be tested while the cars are in the shop, and in winter the steam-heating apparatus is also tested. At the tracks on which the cars stand after coming in from a trip, arrangements are also made for trying the brakes, and the movement of the piston in the air cylinder is carefully noted every time the cars arrive on these tracks.

The shops of the

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE,

or as they are commonly called the "Soo" shops, are in Minneapolis. This road is new and the shops are not yet running in the way in which they were planned. The buildings are models of what shop buildings should be, and provisions have been made for traveling cranes and all conveniences which will facilitate the handling of work. All machinery which has thus far been put in is of the best quality, and everything about the place indicates that the future as well as the present needs have been carefully studied. A wheel grinder is being put in. The machine was built by the Springfield Glue and Emery Company from the patents of Miller & Lindstrung. The blacksmith shop is free from smoke and gases, as is the machine shop, so perfect is the ventilation. On the top of the upright steam hammer a light swinging crane has been placed, which greatly facilitates the handling of light work at the hammer. In the car shops ten large furniture cars are at present under construction.

In a small, neat brick building which was originally built for another purpose a room has been fitted up with all the apparatus necessary for an air brake school, and here the men receive instruction. Over the offices is a room in which during the past winter a drawing class met, and it is the intention to continue this work during the coming winter.

In the roundhouse are a number of drop pits by means of which one or two pairs of drivers can be removed at once. They will ultimately be arranged so that the wheels can not only be dropped, but also moved to one side and raised again to the level of the floor. The cinder pit outside the roundhouse is open on one side and cars are run on an adjacent low track to a point opposite the pit, where one handling of the cinders and ashes is all that is necessary to load them on the cars for removal.

The oil house has six horizontal tanks, and an elevated track along one side of the house permits the oil tank cars to be unloaded directly into the tanks, the oil flowing by gravity. In the room where the oil is drawn from the tanks there is a glass gauge for each tank, and a scale back of the glass will show at a glance the amount of oil in the tank. Waste bins are also located in the same building. The structure is fireproof, and care has been taken to ventilate it properly.

A camera is used to record many important things which come up in the mechanical line. Imperfect materials are photographed and all data marked on the back of the photograph. In this manner valuable information is gradually accumulated, and in some cases the company protected from being compelled to pay for poor material or improper workmanship.

An engine on this road has been equipped with the Woolf valve gear, and is doing very good work.

THE ST. PAUL & DULUTH

shops are at Gladstone, a station on that road about five miles from St. Paul. The shops are large, well lighted and ventilated, and nicely equipped for their work. Both locomotive and car work is done here, but as this season of the year is a busy one on this road, there is but little car work done at this time. The work is generally so planned that at the beginning of the summer season all their passenger equipment has been put in the best condition. Freight car repairs are also light at this time. A new combination car is now being constructed, and that is the only new car work at present.

The transfer table is operated in rather a novel manner. A turntable is placed near one end of the pit, and after an engine runs a car on the transfer, it goes back about 100 feet to a switch, then forward on the turntable, where less than a quarter turn places it in a position to pull the table, or by snatch block to run a load on or off the transfer.

The arrangement of the machinery in these shops is very good, and has been made with a view to the least amount of handling and trucking of the work when in process of construction.

In the yard is a side plow for unloading ballast from cars. It was found that the common plow was very destructive to the car, and this one has been fitted with one set of rollers which take the weight of the plow, and a second set which take the horizontal thrust against the side sill. It has given excellent results in service.

THE CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA road has locomotive shops at St. Paul, but the principal car shops are at Hudson, Wis. Their shops at St. Paul are very good. Like the Chicago, Milwaukee & St. Paul, this road also has considerable trouble with bad water on some parts of the line.

The erecting floor is fully occupied at present, and one or two engines are being overhauled in other parts of the shops for lack of room in the erecting department. The stationary boilers which furnish steam to the shops are fitted with the Smith water purifier, and by blowing out every two hours very good results are obtained.

This road also pays considerable attention to the fuel question, and the monthly fuel record of each engine is posted up in the roundhouse. There is one engine here equipped with the Woolf valve gear, and a very close record is being kept of her performance. The engine is at present engaged in heavy passenger service, generally hauling a train of ten cars, four of which are sleepers, and her record thus far is excellent. The eight-wheeled engines which are used by this road in the heavy and fast passenger service are doing wonderful work for the weight they have on the drivers. With 18×24 inch cylinders and a weight of but 56,000 to 58,000 pounds for adhesion their regular train is ten heavily loaded cars. The engines are all very carefully counterbalanced, and as a result are very smooth-riding. In the machine shop a small stationary engine is standing which is soon to be shipped some distance out on the road, where it will run a stone crusher, as this road is preparing to stone-ballast a large portion of its tracks.—*Railway Review.*

The Effects of Tight Clothing.

Now that rational ideas as to dress have acquired a definite place in public esteem, it may be imagined that the practice of tight lacing and customs of a like nature, if known at all, are not what they used to be. A case of sudden death lately reported from Birmingham proves that it is still too early to indulge in such illusory ideas. The deceased, a servant girl of excitable temperament, died suddenly in an epileptoid fit, and the evidence given before the coroner respecting her death attributed the fatal issue to asphyxia, due in a great measure to the fact that both neck and waist were unnaturally constricted by her clothing, the former by a tight collar, the latter by a belt worn under the stays. We have here certainly those very conditions which would lead us to expect the worst possible consequences from a convulsive seizure. There is no organ of the body whose free movement is at such times more important than the heart. Yet here we find, on the one hand, its movement hampered by a tight girdle so placed that it could with difficulty be undone at a critical moment; on the other, a contrivance admirably adapted to allow the passage of blood to the brain, while impeding its return. This is no isolated case as regards its essential character, though, happily, somewhat singular in its termination. Minor degrees of asphyxiation, we fear, are still submitted to by a good many self-torturing children of vanity. The tight corset and the high heel still work mischief on the bodies of their devoted wearers. Taste and reason, indeed, combine to deprecate their injurious and vulgar bondage, and by no means unsuccessfully. Still, the evil maintains itself. Cases like that above mentioned ought to, if they do not, open the eyes of some self worshipers of the other sex, who heedlessly strive by such means to excel in a sickly grace. We would strongly impress on all of this class the fact that beauty is impossible without health, and would advise them, in the name of taste as well as comfort, to avoid those methods of contortion, one and all, by which elegance is only caricatured, and health may be painfully and permanently injured.—*Lancet.*

Flexible Metallic Tubing.

Considerable interest was shown at the Brussels exposition in 1888 in a form of flexible metallic tubing exhibited by the Belgian and Colonial Flexible Metallic Tubing Company, of Brussels, Belgium. The tubing was formed by wrapping strips of metal spirally around a mandrel. The metal strips were bent over at both sides and a thin, narrow rubber band was inserted to prevent leakage. The tubes could be bent in any direction, were perfectly tight, and were claimed to possess great resistance to both internal and external pressures, and to be easily handled and repaired. They were designed to compete with rubber hose in its various applications, and, according to present accounts, have met with a fair share of popularity. The tubing shown at Brussels was of brass and of a wide variety of sizes.

A Visit to the Eiffel Tower.

Mr. Murat Halstead, of the Cincinnati *Commercial Gazette*, who recently visited the Eiffel tower, thus replies to many questions which have been asked concerning it:

What effect has the heat of the sun upon the structure? The increase in height during a very hot day is said to have been seven inches. Is advantage taken of the extraordinary altitude secured to make scientific experiments? Certainly. I noticed from the cage, when ascending, that heavy plummets were suspended at intervals. The use of them doubtless is to ascertain the extent of the vibration in the wind, or the degree to which the lofty edifice is affected by the machinery. One can feel the force of the wind, which was blowing a strong breeze when I was at the greatest height, quite sensibly, and there is noted a slight trembling, imparted by the movement of the elevators. Is it cold on top of the tower? Not with ordinary observation to a perceptible degree, but many people state that their hearing is troubled at the utmost elevation, as in climbing mountains. What is the cost of getting up the elevator? It is five francs to the top—two francs to the first platform, one thence to the second platform, and two from the second to the summit. How many elevators are running? Four. There are two from the foundation to the first platform—one stopping there and the other going to the second direct—and two from the second to the top, each of the latter lifting about three hundred feet.

How many people are taken at once in the cage that goes to the top? I think the number is sixty. There are no seats in the square iron boxes, with the sides partially of glass, that are employed in the high places. There are seats in the lifts to the lower platform. The guard having charge of admission punches a certain number of tickets for the top at the station on the second platform and then closes the door. What change is made between the third and fourth elevators? Simply that of transfer of passengers from one cage to another. How large is the first platform? The exact measurement I have not taken pains to learn, but think there is about an acre. The central portion of it is open, and one looks over a railing upon the inner fountains. What safeguard is there against fire? Immense iron tanks, looking like the boilers of a great ship, filled with water, are on the second platform—the elevation is about three hundred and fifty feet. The arrangements are such that if any of the wooden structures on the platform or the material knocking about that is combustible should get on fire, the flames would be speedily overwhelmed. What provision is made for drainage? There are large iron pipes extending to all the platforms and connecting them with the sewers.

How far are people permitted to ascend on foot? They can go as high as the second platform, and pay the same for the privilege that they are charged for riding in the elevators. What is the arrangement for those on the stairways to pass each other? There are two lines of stairs, or series of stairways, one for ascending and the other for descending, and no one is permitted to go the wrong way on either of them—therefore there is no meeting or passing on them. The stairs in the midst of such a colossal edifice look slender, but are quite strong and shrouded in oil cloth, to prevent those who venture on them from being affected by giddiness. Going down the stairs is rather more ticklish to the average head and foot than going up. It is trying to look off through the prodigious iron lattice work that rises into the skies and behold the great city at one's feet. There is a sensation as if one might possibly step out into the air and find even a sustaining cloud. Are people permitted to walk to the top? They are not allowed to go, except in the elevators, above the second platform. There is a stairway for the extreme ascent, but it is used only by the workingmen, and I saw no one on this perilous path, which winds about the central pillar, that is a tube, until it seems to fade into the fine lines of the thread of a screw. There are few heads strong enough, I fancy, to ascend to the dizzy elevation upon the giddily spun web of steel, and few, indeed, who could get down that frightful way. There is no communication between the platform from which the upper elevators run and this celestial stair. There is freedom about taking the stairs from the bottom and from the lower platform to the second.

What provisions have been made that there shall not be a dangerous mass of people at the top of the tower? If the crowd becomes too large, the elevators are stopped. This does not happen often, because the usual individual when he has reached the extreme height, and given a few minutes to observation, is quite willing to descend, and does it with a sense of having accomplished something worth talking about. Many give indications of a feeling of exhilaration over the achievement. They are glad they have done it, and do not want to spoil everything by waiting for anything queer to happen. What is the explanation of the delay in using the elevators, of which so much has been said? Why does it take hours to get to the top? Simply the fact is the throng is so great that people are detained in queues waiting their turn. Such is the crowd on the second platform in the afternoon engaged in the tedious task of going to the top, that many stand for two or three hours in the queues; and thousands are restrained by this trouble from making the complete ascension.

What is the contemplation of the French people as to the permanence of the tower? The contract provides for twenty years, and there are delicate and important questions as to the possible changes during that time in the material employed. It is proposed to keep the tower well painted. Have any deflections of the tower from the perpendicular been noticed? I think not. Constant attention is paid to that matter, and in case a variation from perfect uprightness should occur, it would be instantly shown by the fine instruments employed; there are hydraulic jacks fixed in the foundations, which would be applied to rectifying the inclination.

What is the peculiarity of the appearance of the lights at the top of the tower? There is noticed first a steady and starry glow at the solid summit, and there are search lights thrown out, at times colored; and these are most conspicuous when the atmosphere is misty, forming long, luminous tracks through the air, the intensity and breadth of the streams of splendor being in harmonious proportion with the uplifted fountain from which they flow. The tower is the great feature of the exposition, and the whole French nation is excited concerning it and pleased with it, and the rush from the provinces to see it guarantees the success of the exposition.

A Veteran of the Second American Railroad.

Nathan T. Swan, of Bangor, says the New York *Sun*, is the oldest railroad conductor in the United States in point of actual service. He began railroading in 1840 as conductor on the Bangor, Oldtown & Milford road, which was the second railroad built in this country, and has been punching tickets ever since. He is now conductor of the principal passenger train on the Bangor & Piscataquis road, running from Bangor to Moosehead Lake and return, a distance of 175 miles, every day, and he is known by all the tourists and fishermen who have traveled that way for years past. There have been great changes in railroading since Conductor Swan began his career on wheels. The Bangor, Oldtown & Milford, better known as the Veazie Railroad, from its projector and principal owner, General Samuel Veazie, was a great institution in its time, but would be a curiosity to-day. It was built about the year 1836, and extended across the back country from Bangor to Milford, a distance of 12 miles, being intended, principally, as a means for the transportation of lumber sawn at the up-river mills to Bangor, although a considerable passenger traffic was also developed. There were no curves, the line running straight as an arrow from one end to the other, big ledges having been blasted out and high hills cut through to make way for the roadbed, while at places great hollows were filled in to avoid anything like a grade.

The rails were 12 feet long, 2½ inches wide, and ⅝ inch thick, spiked to timbers, after the fashion of a street car track. The rolling stock at the outset consisted of two 6 ton locomotives, built by Stephenson, at Newcastle-on-Tyne, England, at a cost of $6,000 each; three passenger cars, built at Cambridge, Mass., at a cost of $1,200 each, and a few flat cars for carrying lumber. The engines had no cabs, while the passenger cars had their entrances along the sides, English style, and the brakeman perched on top. Six miles an hour was the maximum speed on the road, but this rate was seldom attained. The old road was discontinued long years ago, but its bed may still be seen stretching across the country like a Chinese wall, and in so good a state of preservation that it is used in places as a turnpike.

The Mosquito.

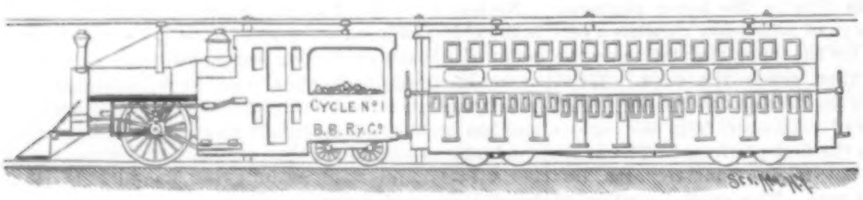
To expel mosquitoes, take of gum camphor a piece about one-third the size of a hen's egg, and evaporate it by placing it in a tin vessel and holding it over a lamp, taking care that it does not ignite. The smoke will soon fill the room and expel the mosquitoes, and they will not return, even though the windows should be left open all night.—*The Doctor.*

I learned the secret of successful warfare against these pests when living in the swamps of Louisiana, where, in summer or winter, mosquitoes swarm. For some years life was unendurable, and no meal could be eaten in peace. But all at once there was a change for the better. Bars and screens were often out of place, but there was almost an immunity from insects. I had just changed my colored boy. The newcomer explained how he kept the "critters" away. He burned small pieces of gum camphor on the cook stove, and used a secret preparation he called "sudekillo." When I married and came to Missouri, I imparted the secret to my wife, and as there is no patent on it that I know of, I would advise all fellow sufferers to go and do likewise. The gum camphor alone is ample for the purpose, and need only be used two or three times a week. —*St. Louis Globe-Democrat.*

THE BOYNTON BICYCLE ENGINE.

This novel machine, suggesting a very radical change in railway construction, arrived in New York last week from Portland, Me., where it was built. It weighs twenty-two tons, and came on a truck attached to the rear of a regular train. The total height of the machine is 15 feet 6 inches, and it has a single driving wheel of 7 feet 9 inches diameter, with double flanges, to ride on a single rail. The cab is two stories high, the upper story being occupied by the engineer and the lower story by the fireman. The engine has two cylinders, 12 by 14 inches each, and is designed to be operated with a boiler pressure of 150 pounds to the square inch. The passenger cars to be drawn by this engine are to be 4 feet wide and 14 feet high, in two stories, and such cars, 40 feet long, are designed to weigh five tons and carry 108 passengers each. The engine and train are to be kept on their single track by upper wooden guiding beams supported fifteen feet above the track below by a bridge-like skeleton frame arching the roadway. The freight cars are to be of similar height and width, and it is designed that the two rails of an ordinary track shall form a double track for bicycle trains, without altering the tracks used for the present cars and engines, the guiding beams and skeleton frames being out of the way of trains made up of locomotives and cars as now built.

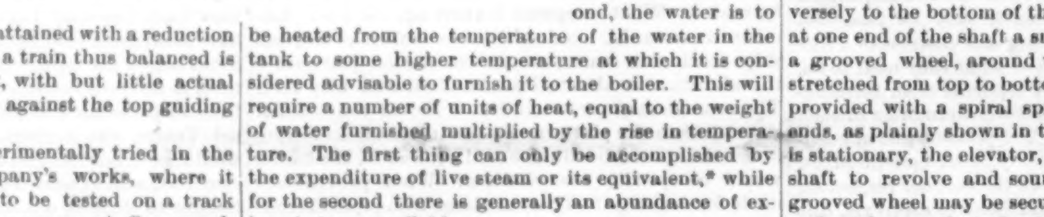
It is designed by this form of construction to save greatly in weight and friction, reducing the weight of the cars, both passenger and freight, relatively to the load carried, and saving power lost in rounding curves, it being intended to so balance the train that there will be but little strain on the top guiding rail, and thus



THE BICYCLE LOCOMOTIVE AND TRAIN.

great additional speed will be attained with a reduction of power. The momentum of a train thus balanced is designed to hold it to its track, with but little actual bearing of the flanged wheels against the top guiding rail.

This engine has been experimentally tried in the yard of the Portland Company's works, where it was built, and it is further to be tested on a track which has been fitted for the purpose at Gravesend, on a portion of road formerly owned by the Sea Beach and Coney Island Railroad. The prospectus of the company promises nothing less than a revolution in the railway business of the country as a result of the introduction of the bicycle railway system, but a few practical proofs of its merits will probably be necessary before this happens.



THE BOYNTON BICYCLE LOCOMOTIVE.

Uninflammable Fire Escapes.

In this city the fire laws require the use of exterior balconies and ladders as fire escapes. Several poor people, however, lost their lives here recently, at a fire in a tenement house, owing to the defective condition of the fire escapes. The floors of the same were made of wood, and were in a blaze when the frightened people came to use them.

The law passed in 1888 in Massachusetts requires the use, under penalty, of "uninflammable canvas chutes" by all organized fire departments of the State. This law has justly been declared a "dead letter" by the fire commissioners of Boston for the good reason that "no such uninflammable canvas chute" could be obtained.

The Putnam escape chute, made of canvas, comes the nearest to the requirements of the law, but it only resists fire when it is wet. Recent trials of it were made in Boston, which are thus described in the *Herald* of that city:

The chute is 40 feet in length by 8 feet in circumference. It is made of tent canvas, is distended at short intervals by hoops of Bessemer steel, and is always dry inside. The water for wetting the outside of the chute was supplied by a one inch hose from the hydrants, and with this small stream the chute was quickly wet and dripping. A large fire of pine wood, saturated with some two gallons of kerosene oil, was kindled directly under, and the flames flashed up fiercely, enveloping the chute.

The inventor then proposed to demonstrate the fact that living persons could pass with perfect safety down through the chute while it was enveloped with flame, and, entering the upper end of the chute, he passed right down through the flames. In a couple of seconds he emerged safely from the lower end of the chute, the company present congratulating him upon his successful demonstration. He was followed by his assistant, Mr. G. R. Wiggin, who also came safely through.

Mr George A. Jenness, of Linden, then entered the chute while the fire was fiercely blazing, and, desiring to make a somewhat thorough examination of its qualities, proceeded to descend, stopping at intervals. Mr. Jenness sat for a considerable time inside, just where the flames were streaming under and around the chute outside, and finally, lying comfortably down, he emerged head downward, amid the hearty applause of the spectators. Mr. Jenness says that he would not hesitate to take a tray of provisions into the chute and sit where the flames were blazing fiercest outside and eat his luncheon at leisure.

The Waste of the Injector.

In feeding a steam boiler with water two things are necessary: First, there is a certain amount of mechanical work to be done in forcing the water in, which is equal to the volume of the entering water multiplied by the difference of pressure within and without the boiler, or more strictly by the difference between the pressure in the boiler where the water enters and the pressure in the tank from which the feed water is drawn plus the pressure corresponding to the height through which the water may be lifted, and, second, the water is to be heated from the temperature of the water in the tank to some higher temperature at which it is considered advisable to furnish it to the boiler. This will require a number of units of heat, equal to the weight of water furnished multiplied by the rise in temperature. The first thing can only be accomplished by the expenditure of live steam or its equivalent,* while for the second there is generally an abundance of exhaust steam available.

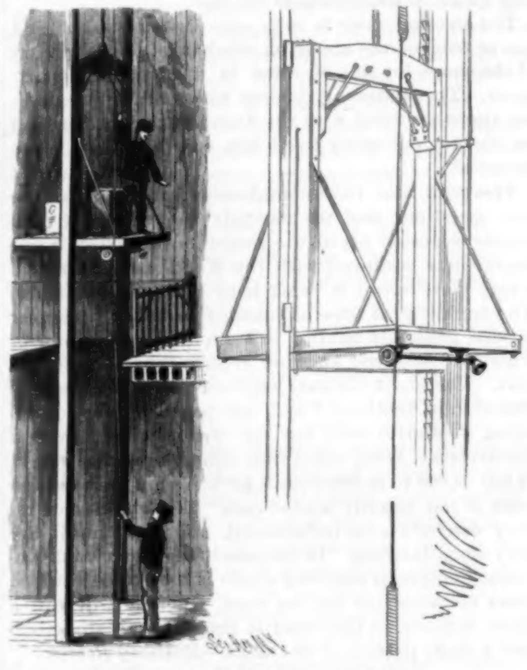
Now, to say that the injector wastes no heat is to a certain extent an evasion, because, although it is literally true that it wastes none directly, it is equally true that by warming the feed water with high pressure steam, it prevents the use of the exhaust steam for that purpose, and, therefore, indirectly causes the waste of as much heat in the exhaust steam as would serve to warm the water. Or, to put the thing otherwise, to say that the injector wastes no heat is to hide a defect. True, it wastes no heat itself, but it wastes temperature, which is all that makes the heat valuable for generation of power.

Whatever steam the injector uses in doing the mechanical work of forcing in the feed water is no doubt well enough used, but the whole amount of steam drawn from the boiler is out of all proportion to the work done, say four times as much as a non-expansive direct-acting steam pump requires, and the most of the steam is used simply to warm feed water.—*J. Burkitt Webb.*

* One of the advantages of the exhaust injector is that the steam exhausted from a high pressure engine is, for its use, live steam, just as such steam would be for supplying a low pressure engine.

AN IMPROVED ELEVATOR ALARM.

The accompanying cut shows an elevator alarm device for which letters patent were granted to Mr. John Einig, of Jacksonville, Florida, June 19, 1888. It con-



EINIG'S ELEVATOR ALARM.

sists essentially of a revoluble shaft secured transversely to the bottom of the car, there being attached at one end of the shaft a small bell and at the other end a grooved wheel, around which is rove a cord that is stretched from top to bottom of the elevator shaft, and provided with a spiral spring at its top and bottom ends, as plainly shown in the outline view. As the cord is stationary, the elevator, when in motion, causes the shaft to revolve and sound the bell. If desired, the grooved wheel may be secured to the shaft by a pawl and ratchet, so that the bell will only ring while the car is descending. This device obviates the necessity of having any other call bells or gongs, such as are usually placed at the different floors to signal the attendant, for by simply taking hold of the bell cord that is rove around the wheel, a slight pull causes the spring to yield and sound the bell, calling the attention of the attendant in charge. The saving of the expense of call bells or gongs and wires of the ordinary pattern is designed to more than pay the cost of this alarm device. The inventor conceived this invention and was impressed with its importance after having narrowly escaped with his life while looking into an elevator shaft to locate the position of the car, a fact which led him to put into practical shape the simple but effectual little device represented in the cut.

Electricity in the United States.

According to reliable reports, there are at present 3,351 isolated electric lighting plants and central stations in the United States alone, operating 192,500 arc and 1,925,000 incandescent lights each night. There are steam engines of 459,495 horse power used for electric lighting. The capital invested in the American electric lighting companies during the past half year has been increased to the extent of $42,210,100. In April last there were in the United States 59 electric railways, with 309 miles of track, operating 440 motor cars, and utilizing about 8,000 horse power for stationary engines. Forty-nine new roads were in February last being built, having a total of 189 miles of track and to use 244 motor cars. There are also several motor factories, some of them employing as many as 1,200 men.

THE HUDSON RIVER TUNNEL.

(*Continued from first page.*)

as at present used. Within this shell a brick lining is placed, of the best brick, laid in hydraulic cement mortar. The brick lining is two and one-half feet thick. The tunnels were started by pneumatic process, and the work is now prosecuted under air pressure. In general terms a bulkhead is established at some point in the tunnel near the outer end. Through this an air lock extends, and a constant air pressure is maintained there. The workmen find in front of them a face of silt to cut through. It is cut out by shovels and is removed by small tram cars, beginning at the top. As fast as removed, the plates of the outer shell are brought forward and bolted to the anterior course, and thus as the silt is removed the plates are put in place, until a complete circle is formed. As fast as a series of circles are finished the brickwork is put in, and the tunnel is complete to that point. To still further prevent air leakage, the brick is treated with a surface wash or thin coating of cement mortar.

This in brief is the plan originated by Mr. Haskin, and now followed, and concerning which much debate was carried on by engineers at the time of its first suggestion. It is essential that a proper material should exist to form the heading, or else special methods have to be adopted. Outlined above, the plan is given in its essentials only.

The present tunnels are in internal dimensions eighteen feet high and sixteen wide, and of oval section. The grade of the tunnel is determined by the limitation of a maintenance of at least fifteen feet of earth between the bed of the river and the top of the tunnel. Its line begins in Jersey City on Jersey Avenue and 15th St., running east to Hudson St. Here it begins to curve to the extent of 5° to the northward in its entire course from this point to the New York City bulkhead line at the foot of Morton St. Thence the line tends slightly to the south and extends to Broadway. The distance from the western terminus to Hudson St. is 3,400 feet, thence to the foot of Morton St. 5,500 feet, and thence 4,000 feet to the eastern terminus. Of course some of the terminal figures may be slightly modified.

On the New York side, work has been begun upon both the north and south tunnels; at present no work is in progress there, the north tunnel being advanced about one hundred and fifty feet, and the south tunnel being barely commenced. On the New Jersey side, the north tunnel was advanced 1,845 feet, and the south tunnel nearly 600 feet, when work was suspended, seven years ago. At the present time nearly fifty feet have been added to the north tunnel, and at a very early day work will be prosecuted in the four headings simultaneously.

In the north tunnel, on the New Jersey side, two air locks are used. About 1,200 feet from the entrance a bulkhead of brick four feet thick is built. This is braced by diagonal timbers, so as to make it exceedingly strong. Through this a cylinder of heavy sheet iron, sixteen feet long and six feet in diameter, is carried. It is provided with two doors, both opening toward the heading. Plate glass windows in the ends admit of communication by exhibition of written messages. This constitutes the first air lock, and in front of it a pressure of air of about twenty-five pounds to the square inch is maintained. A short distance back of the heading is the second bulkhead with its air lock. It is deemed essential that this bulkhead shall be close to the work. In front of it the pressure is kept at 32 to 34 pounds. The two locks make it much easier to enter than in the generality of caissons, where the full change of pressure has to be undergone in one lock.

On entering the tunnel from the shaft it is found to be about two-thirds filled with silt. On this a narrow gauge tramway is laid, which is continued through the air locks. The tunnel is kept filled to this extent, the removal of this portion of the excavated ground being left to the last. On passing through the last air lock the vertical face of silt is seen. This is a clay-like substance, of the consistence of putty, and, as the engineers put it, holds water and air. It possesses so much cohesion that, supported by the air pressure, it excludes water perfectly. Here the men are seen cutting it away in stopes, putting the iron plates in position and laying brick. The tramway is used for removing the silt and bringing in the material. Each row of plates is called a ring, and four rings constitute a section, which is ten feet long. The bricklayers work directly behind the plate layers, the former beginning their work at the invert, generally working the length of one section. The average of progress of the finished tunnel is three feet a day, but greater progress will soon be made.

In advance of the large tube a smaller one called the pilot tube is carried. This is made of ¼ inch iron plates and is but 6 feet in diameter. It is carried from 30 to 60 feet in advance of the main tunnel. The radial braces are supported by it, which support the plates of the main tunnel tube while being put in place. The pilot gives the ground a thorough exploration, and enables any weak spots to be more easily guarded than if the main tube was at once advanced. It effects other important results, such as the prevention of slides, and is an indispensable adjunct to the work.

Before any of the new work had been finished, operations were delayed by a large hole where the river bottom had caved into the end of the tunnel. This was overcome by a very ingenious method. An old sail was procured and placed upon a rough network, made of old wire rope, etc. A quantity of loose hay, brick, and stones was placed in its center, and around the heap a wall of bales of hay, two high, was carried. The pit this formed being filled, the sail was gathered together and the netting was carried over its top, and the whole was brought into a roughly globular shape, about ten feet in diameter and weighing twenty-five or thirty tons. It was hoisted by a floating derrick, and lowered at slack water into the hole. Upon it a quantity of hay and stones and other material, followed by three scow loads of earth, were deposited. This effectually stopped the leak, and the place is now well back of the heading.

The favorable nature of the material and the fact that the four headings are well started puts the tunnel in a position for rapid completion. For the north tunnel about 550 days will be required to carry it from shaft to shaft. For the south tunnel about 700 days are allowed. This is the work that presents the most serious difficulties. The terminal sections can be put in progress at any time. In New York very extensive plans for underground terminal and intermediate stations have been designed. In Jersey City the end of the cut leading to the tunnel is within easy reach of all the railroads terminating there. About $2,000,000 will be expended in completing the river section of the north and south tunnels.

WORK AT THE HEADING OF TUNNEL AND VIEW OF PILOT.

A Large Block of Coal.

An exhibit that presents a certain curious interest at the Paris exposition is that of the Abercorn coal mines of England. Huge blocks of coal have been detached in a single piece at these mines and sent in their entirety to the exposition.

One of these blocks weighs 5 tons and a half, and measures 7½ feet in length, 5½ in width, and 3¼ in thickness. This block made at the bottom of the mine a trip of 5,250 feet before reaching the shaft through which it was to reach the surface. Before being raised to the surface, it was rough-trimmed and squared in place, so that its present dimensions are still less than they originally were.—*Le Genie Civil.*

The Man-eating Tigress.

A correspondent writing from India to the *English Mechanic* says: The notorious Jounsar man-eating tigress has at last been killed by a young forest officer. This tigress has been the scourge of the neighborhood of Chakrata for the last ten years, and her victims have been innumerable. On one occasion she seized one out of a number of foresters who were sleeping together in a hut, carried him off, and deliberately made him over to her cubs to play with, while she protected their innocent gambols from being disturbed. His companions were eventually forced to take refuge in a tree from her savage attacks. Here they witnessed the following ghastly tragedy.

The tigress went back and stood over the prostrate form of her victim and purred in a cat-like and self-complacent way to her cubs, who were romping about and rolling over the apparently lifeless body. She then lay down a few yards off, and with blinking eyes watched the gambols of her young progeny. In a few moments the man sat up and tried to beat the young brutes off. They were too young to hold him down, so he made a desperate attempt to shake himself free, and started off at a run; but before he had gone twenty yards the tigress bounded out and brought him back to her cubs. Once more the doomed wretch had to defend himself over again from their playful attacks. He made renewed attempts to regain his freedom, but was seized by the old tigress and brought back each time before he had gone many yards. His groans and cries for help were heartrending; but the men on the tree were paralyzed with fear, and quite unable to move.

At last the tigress herself joined in the gambols of her cubs, and the wretched man was thrown about and tossed over her head exactly as many of us have seen our domestic cat throw rats and mice about before beginning to feed on them. The man's efforts at escape grew feebler. For the last time they saw him try to get away on his hands and knees toward a large fir tree, with the cubs clinging to his limbs. This final attempt was as futile as the rest. The tigress brought him back once again, and then held him down under her forepaws, and deliberately began her living meal before their eyes.

It was this formidable beast that the young Cooper's Hill officer and a student attacked on foot. They were working up her trail, fifteen yards apart, when suddenly Mr. Osmaston heard his younger companion groan, and, turning round, saw him borne to the ground by the tigress. Mr. Osmaston fortunately succeeded in shooting her through the spine, and a second ball stopped her in midspring. Meantime his companion rolled over the hill, and was eventually discovered insensible a few feet away from his terrible assailant. He is terribly mauled, but hopes of his recovery are entertained.

A Cluster of Comets.

Professor E. S. Holden writes from the Lick Observatory August 3, that the comet discovered by Mr. Brooks, of Geneva, N. Y., July 6, has been regularly observed at the Lick Observatory by Mr. Barnard. On August 1 he found the comet attended by two objects, and on August 3 his observation showed them to be companion comets. One of them had a decided tail. Besides the three comets mentioned, there are four objects near, which are probably members of the same family. This phenomenon is a rare one, though it has been observed before.

A Twelve Mile Gun.

The great 12·60 inch De Bange gun excites much attention at the Paris exhibition. It was tested on the trial ground at Calais on May 7, 8, and 9 last, with the following results:

Total length	41 ft. 0·1 in.
" weight	47 tons.
Weight of projectile	880 lb.
Initial velocity	2132 ft.
Range with elevation of 10 deg	10,000 yards.
" " " 30 deg	20,770 "
Thickness of iron plate penetrated at short range	35·43 in.
Thickness of iron plate penetrated at 1,500 yards	29·53 "
Thickness of steel plate penetrated at short range	23·62 "
Thickness of steel plate penetrated at 1,500 yards	19·69 "

The greatest range, it will be noted, was a trifle short of twelve miles. A war ship capable of carrying and discharging these weapons might lie three miles out in the ocean off shore at Coney Island, and throw projectiles into the cities of New York and Brooklyn. Our war department should begin to think about obtaining some of these arms. They have been illustrated in the SCIENTIFIC AMERICAN and SUPPLEMENT.

The Storage Battery and its Use upon Street Cars.

At the recent meeting of the National Electric Light Association a paper by Mr. Bracken was read on the above subject, from which we make the following abstracts.

The clearest idea I can give you of the energy contained in a storage battery is to compare it with a lump of coal. The source of energy in a battery is identical with that contained in coal. It is merely energy locked up in a number of substances, principally the metals, that, when set free in a certain manner, manifests itself in a certain phenomenon we call an electric current. The metal almost universally used in the storage battery is lead in its various forms. In this lead is contained latent energy, the same as in coal, and if we compare the amount of work accomplished by the energy from either source in foot pounds, we will find it to be exactly equal in both cases. Now the general principles involved in a storage battery are very simple. When we charge a battery from a dynamo or other external source of electricity, we are manufacturing lead, and when we discharge a battery through an electric motor or series of lamps, we are simply burning lead. But there is this difference between the action of coal and lead, that whereas coal apparently disappears when burned, the lead does not, but is converted into sulphate of lead, to be converted back to metallic lead again by a reversal of the current, so that the storage battery is alternately burning and reducing lead to and from one of its salts. This is why the storage battery lasts, and does not disappear in the extraction of the energy as coal apparently does. In fact, the storage battery is an ideal illustration of the conservation of force and the indestructibility of matter.

When the storage battery first became known in a practical and commercial form by the experiments of Plante in 1859, scientists foresaw for it a great future.

There probably have been few things more difficult to accomplish than to bring the storage battery to its present state of commercial value.

The obstacles in the way of the success of the system are largely, if not wholly, overcome. The chief of these was the handling of the batteries. That was the most difficult and the last obstacle to be overcome. Two improvements removed these difficulties. First, the flexible connector, by which it is possible to couple up or remove cells with great rapidity; and secondly the battery rack, occupying a floor space of 24 × 7 feet on each side of the car, wherein can be stored a sufficient number of batteries to run from 10 to 20 cars, according to its location. This rack represents stall room for 150 horses, or say 6,000 square feet. I regard this rack as the greatest improvement hitherto made in storage battery traction. By its aid we remove the batteries from a car and replace them by another set in from two to three minutes. Indeed, the cars on Madison Avenue, New York, have to leave the station on six (6) minutes headway. In the afternoon trips there is but six minutes interval between their arrival and departure; and they all receive their batteries from the same rack. When the car enters this rack, its panels are dropped down on either side and thus form bridges over which the batteries are withdrawn from and replaced in the car. While this change is being made, a competent person inspects the regulators of the car. The motors, gearings, and connections are only inspected once a day, and that at the end of the day's work. You will thus perceive that the great bugbear of how to store the batteries is no longer an element in storage battery traction.

From my observation of the recent work on Fourth and Madison Avenues, now that a number of cars are running and under very unfavorable conditions as to station room and the like, I am led to believe that the storage battery car is as free, if not freer, from accident as cars that are run by the overhead system. The motors are, I think, subject to the less trying conditions, owing to the fact that the E. M. F. is always uniform. The batteries never give out on the trip. It is impossible for them to do so, as they leave the station with 35 electrical horse power hours stored in them, and do not consume quite 12, in the round trip of 12 miles. The batteries in service have never been short-circuited. When the current required exceeds 150 amperes, the battery is automatically cut out. When rigid connectors were used, breaking was frequent, and the flexible connector has until recently given some trouble from time to time by jumping out of position, while the car is in service; but with recent improvements, disconnection of the batteries, while the car is in service, is now rendered almost impossible. For several months past the regulators have caused absolutely no trouble. In any event, there are two on a car, so that if one should fail, the car may be operated from the other end. You will thus perceive that the likelihood of accidents or breakdowns is reduced to a minimum. The first standard car has run in three months over 6,000 miles and carried over 30,000 passengers, never having missed but one-half a trip in that time; and that arose from a bent axle. It has never had an accident or stoppage of any kind while in service. Do not be skeptical at the assertion that not a dollar has been spent on that car in the way of repairs or alterations.

At this stage you will naturally ask, how about the life of the battery? I answer that from our observation, we have nothing to fear on that score. We only ask a life of six months from the positive plates. That is sufficient. It is found that they will last very much longer than that. The chief reasons why the shortlivedness of a storage battery has been so much talked about and feared, is that it has, until recently, cost so much to manufacture the battery. Now, the material for your battery you have to buy, in a great measure, but once, for the reason that the discarded battery can be made over new. The raw material in two sets of battery, capable of running a car 120 miles a day, costs, exclusive of the containing jars, about $300. Have you machinery and devices requisite for manufacturing this raw material cheaply into a battery? If you have, you need have nothing to fear on the score of economy. It will cost $4,000 to purchase enough horses to run a 16 foot car 120 miles a day; it will cost about $1,500 to purchase enough battery to do that work. The batteries can be maintained for about one-half what it costs the horses, and by maintaining, I mean replacement as well as feed. This I know for fact. Can we then have any further doubt as to the relative economy of storage battery traction?

The cars on the Madison and Fourth Avenue line take one electrical horse power hour per mile. The road has some long gradients. The grade at Center Street is over 4½ per cent and 600 feet in length.

The cost of motive power for a car day of 75 miles we estimate at $3.40, as against $7.50 for horses. Five dollars for 75 miles ought to cover the cost in winter. By motive power we mean the cost of energy at two cents per horse power hour, and $700 per annum for maintenance of batteries and motors. To those who may think that two cents per horse power hour is a low estimate, it may be said that power has been offered in New York, to be delivered at the station, at the price above named. In towns outside of New York, offers have been made to supply current at lower figures. The more level the road, the cheaper, obviously, will be the cost of motive power. This is more particularly true of the storage battery, which, in excessively steep and long grades, becomes heated. The chemical energy, instead of exhibiting itself in the form of electrical energy, exhibits itself in the form of heat, with consequent injury to the battery.

Cars will ascend very steep grades, but it is not deemed economical to attempt grades of more than six per cent, and they must be short at that rate. But there are few roads offering more and steeper grades than the road we are now operating on in New York. Each car has two sets of battery. A set is easily charged in about two-thirds of the time the other is in service. No time is lost in charging, as the battery is automatically put in circuit with the dynamo as soon as it is withdrawn from the car.

The New Notation of Time.

The following are the remarks on the 24-hour notation by the chairman of the special committee on uniform standard time, American Society of Civil Engineers.

1. The practice of dividing the day into halves, numbered 1 to 12 in each case, distinguished as A. M. and P. M., has long been in use, but there is nothing to recommend it but custom and antiquity.

2. If this system of division be attended by any special benefit, it may be asked would it not equally be an advantage to have the hour, the week, the month, similarly divided into half hours, weeks, and months, the one half in contradistinction to the other?

3. If the practice be good and wise, why not extend it to the currency, and reckon by half dollars of fifty cents, in place of whole dollars of one hundred cents?

4. The division of the day into halves at noon is productive of inconvenience, and the feeling must be one of surprise that it was ever made.

5. Since the introduction of railways, countless mistakes and delays involving loss have occurred, owing to the misprinting of the letters A.M. or P.M. Even when these letters are correctly given, the detail of the timetable is very often understood with difficulty. There is scarcely a traveler who has not to regret some misunderstanding, and disappointment, arising from this imperfect distinction.

6. The old A. M. and P. M. usage offers no single advantage. The new system of reckoning the hours from one to twenty-four is without a single objection. It is in use on thousands of miles of railway with singular success.

7. The adoption of the new notation completely removes all doubt as to the hours of the day. In special cases during its introduction, it may be well to add some explanatory words; thus, it could be stated with reference to an important engagement, "It will take place at 19:45 (7:45 o'clock P. M., old style)." Generally such addenda will not be necessary, and in a short period the new nomenclature may be used without explanation in any case.

8. It is suggested that a "colon," two vertical dots between the hours and minutes (thus 19:45 or 17:08), will be a sufficient distinctive mark for all ordinary purposes. A "colon," so placed, will at once denote time and separate the hours from the minutes in the same manner as a single dot denotes decimals and separates whole numbers from parts of numbers. Generally there will be no necessity for adding the words "o'clock," or "hours" or "minutes." A "colon" so placed will be taken to denote time as unmistakably as % denotes per cent, as the $ stands for dollars, and £ s. d. are the symbols for pounds, shillings, and pence.

9. The 24-hour notation has received the authority of the Washington conference. The representatives of the first of the world's nations resolved that the old usage of numbering the day by two sets of hours (twelve in each set) should be discarded, and that the hours of the universal day should be continued in a single series, from one to twenty-four (1 to 24). A slight acquaintance with modern scientific publications will establish that the new notation is favored by all men of intelligence who have examined the question.

10. The 24-hour notation will not involve any change in the character of ordinary clocks and watches now in use. All that is necessary is to place on their dials the new numbers of the afternoon hours in an inner circle, or in such other manner as experience may dictate. The temporary means employed by railway managers in introducing the new notation is described below.

ADOPTION OF THE 24-HOUR NOTATION.

1. The adoption of the 24-hour notation is favored by prominent men of science in Russia, Germany, Italy, Spain, France, Great Britain; and indeed throughout Europe generally. It is warmly supported in the United States and Canada. It has no stronger advocates than the Imperial Astronomer of Russia and the Astronomer Royal of England. It has long been in common use in Italy and Bohemia. One of the great clocks over the portico of St. Peter's, at Rome, has the dial adapted to the 24-hour notation.

2. It has been brought into daily use on the great lines of telegraph communicating from England to Egypt, India, China, Australia, and South Africa.

3. The Canadian Pacific Railway adopted the notation on the opening of the line from Lake Superior to the Pacific coast in 1886. It was continued in use only to obtain more assured favor.

4. It has likewise been accepted by the Canadian government on the intercolonial line from Quebec to Halifax. Since the beginning of 1888 it has been employed for railway purposes in the provinces of Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Assiniboia, Alberta, and British Columbia. A few months back, the 24-hour system was adopted on the railways in China.

5. Wherever it has been adopted on railways it has been found advantageous in facilitating the movement of trains and promoting the public safety. Experience has shown that, in the more intelligent and progressive communities, the public have readily accepted the change. The press, generally, has expressed a favorable opinion with regard to the new notation.

6. It has been received with favor in nearly every quarter where it has been considered, and it is believed the day is not far distant when it will be brought into common use on railways generally throughout the world.

7. In introducing the 24-hour notation, the railway managers provide the means of adapting existing clocks and watches to the change. Extra dials are prepared and furnished free of cost to employes and to others who may desire them.

The following directions for applying the new dials are generally issued.

"The extra dials furnished are of thin paper of sufficient size to contain the new afternoon hours, 13 to 24, within the existing Roman numerals I to XII. They are cut to the proper size, pierced for the axis of the hands, coated with gum like an ordinary postage stamp, and made ready for application.

"If the watch or clock has a second hand, a segment should be removed from the extra dial to make room for it.

"In applying a new dial, moisten every part of its gummed surface, carefully place it in position, and press it evenly and firmly so that every portion will adhere to the old dial. Unless this be done, the new dial may scale off or blister, and interfere with the hands.

"The best time to apply the new dials is at half-past four, half-past five, half-past six, or half-past seven, when hour and minute hands are together and little in the way."

This temporary and inexpensive expedient admirably answers the desired purpose. Clock and watch manufacturers are now beginning to furnish other and more permanent means to meet the requirements of the new notation.

FOUR million shoe boxes were used by New England manufacturers last year. They cost from 25 to 50 cents each.

[SPECIAL CORRESPONDENT OF THE SCIENTIFIC AMERICAN.]

THE PARIS EXHIBITION.

THE STATIONARY ENGINE EXHIBITS.

PARIS, August 20, 1889.

The stationary engine exhibits are so scattered that it takes some time before one realizes how large it really is, and that it is second only to the exhibits of machine tools. Of course, so far as the principles noticed in the various designs are concerned, we have nothing particularly startling here in the engine line; but in the various details there are many items that appear strange to American engineers, and it is to these, whatever their nature or quality may be, that I propose drawing attention.

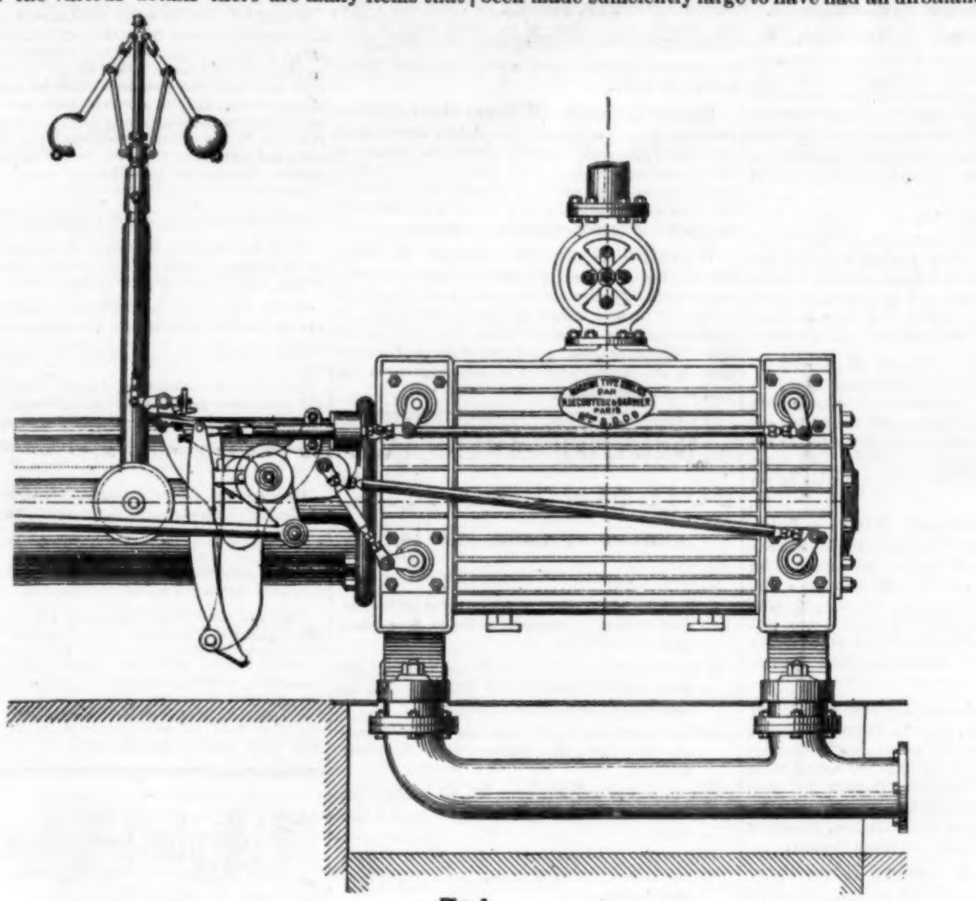


Fig. 1.

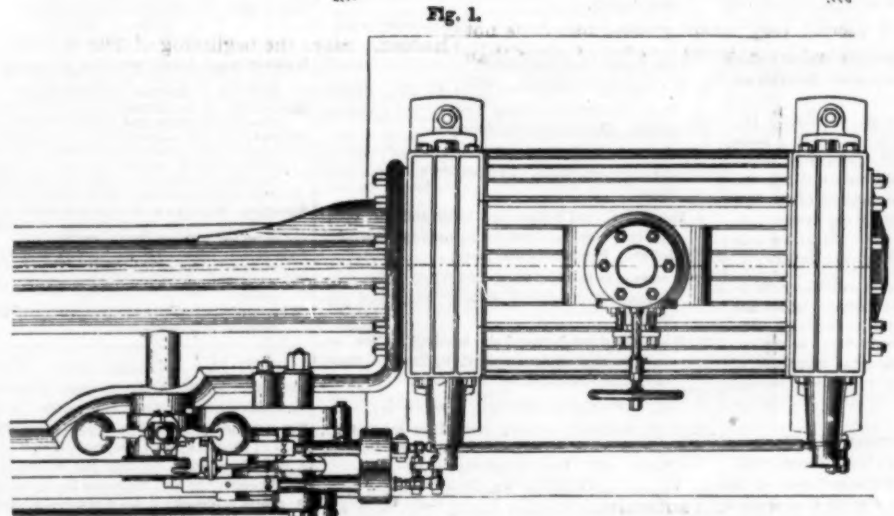


Fig. 2.

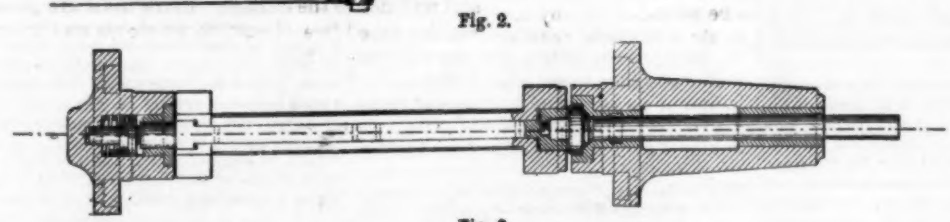


Fig. 3.

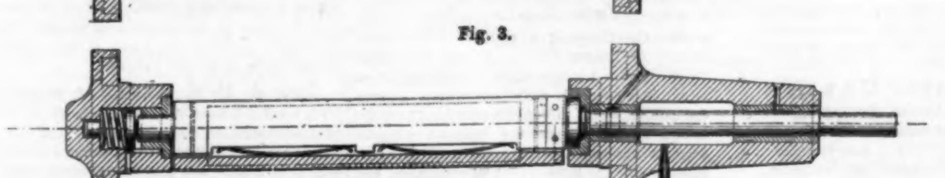


Fig. 4.

To begin with, then, we have in Fig. 1 a front elevation and in Fig. 2 a plan of a part of what is called by its exhibitors a perfected Corliss engine, Figs. 3 and 4 representing the valves and Figs. 5, 6, 7, and 8 different portions of the trip motion. This engine is a fair example of a class mentioned in my last letter as being Corliss engines, inasmuch as that they have trip mechanisms for the admission valves.

The wrist plate that is so distinctive a feature of the Corliss engine as made in the United States is here, it will be seen, conspicuous by its absence, as are also the dash pots and *crab claws;* but on inspecting the valves we find they are so constructed as to follow up the wear like the Twiss engine of the United States, while glands for keeping the valve spindles steam-tight are dispensed with, after the style of the Harris-Corliss engine of Providence, R. I., the collar making the steam-tight joint without the aid of any packing whatever.

Referring to Figs. 3 and 4, it is not altogether clear why the two springs are employed, because it is seen in Fig. 1 that the valves rest themselves upon their seat, and the live steam is keeping them seated. Again, the area of the inside end of the valve spindle might have been made sufficiently large to have had an unbalanced area at the end to insure the collar at the other end making a tight job.

It is, perhaps, hardly necessary to say that the revolutions per minute of this engine are not up to what Corliss obtained; but the high piston speed is not so greatly valued here as in the United States, no Corliss engine I have yet seen making more than about 450 feet of piston motion per minute.

An engine for well boring (constructed by the Societe Anonyme de Marcinelle et Couillet) for oil wells has a 30 foot flywheel (at present in skeleton only) and built-up arms, and all of wrought iron angle iron. The arms bolt to a cast iron hub and rivet to cast iron segments extending about three feet out from the hub. They (the arms) are simply two angle irons riveted together, and have bolted on their faces a wooden spoke, about 6 inches wide and say 3 inches thick. There are three rings of angle iron ready to rivet (or bolt, as the case may be) the wheel face on.

This engine has a Corliss frame, with a pair of eccentrics operating a Gooch link, which operates a trip motion valve gear, the steam valves being on the top of the cylinder and the exhaust valves at the bottom. From the top of the above link a rod works a pump for forcing the oil for the lubrication of the cylinder, etc. The connecting rod is solid, with a square solid forged oil cup, and the connecting rod key upside

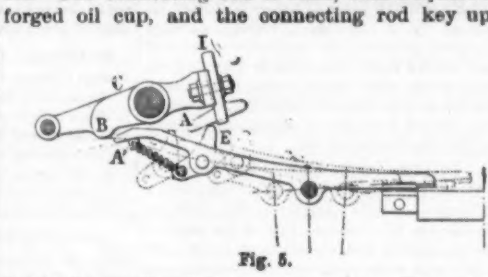


Fig. 5.

down, the small end being uppermost. The gib beds against a solid block of iron that beds against the whole back of the brass, and this distributes the steam all over the brass and prevents the stretching and distortion that ensues when the gib bears direct upon the brass. I may mention here that the official called the *gardien* (who watches to see that the official rules are obeyed) wanted to prevent me from taking notes even, and insisted for some time that I had no right to do so. Once before to-day I was partly arrested for sketching; but upon the *gardien* being satisfied that I had already had the matter determined by the *commission-*

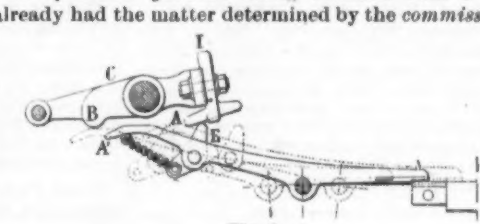


Fig. 6.

aire de police, he explained (when half way to the police bureau) that the attendants had complained, and that he was, therefore, compelled to appear to take some proceedings in the matter, and then he walked off and left me. A feature of the above engine is the employment of a Porter governor in connection or, rather, with the addition of a dash pot.

Victor Popp et Cie. have a pair of horizontal air compressors here, the cylinders being arranged tandem, there being a crosshead guide not only at the tail end of the air cylinder, but also between the two cylinders. The steam cylinders are about 4 feet diameter and 8

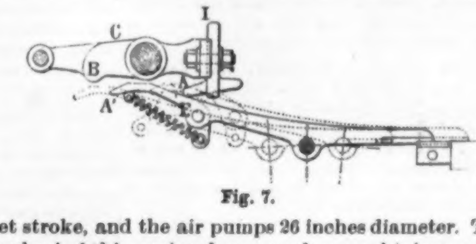


Fig. 7.

feet stroke, and the air pumps 26 inches diameter. The flywheel of this engine has round wrought iron arms keyed into a cast iron hub and a cast iron rim. The main bearings have side chocks to the brasses—a construction that appears to be gaining ground here on stationary engines.

Messrs. Carels Freres exhibit a pair of horizontal condensing engines (cylinder 4 feet by 8) with a peculiar trip motion, which may be explained as follows: A revolving shaft, driven by gears from the crank shaft, carries two eccentrics. The top half of the strap of each eccentric has an extension or toe on it that, during a short part of the revolution, meets a toe plate and leaves it naturally without any actual tripping

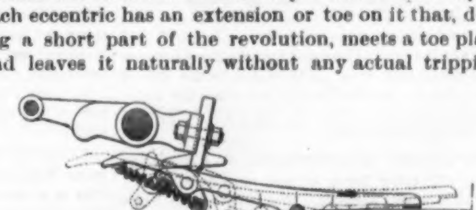


Fig. 8.

motion. The period of contact, and therefore of steam admission, is determined by the governor. The bottom half of each eccentric strap drives a rod that actuates an exhaust valve placed directly beneath the engine, and working vertically with a spiral spring to seat the valve and a certain amount of lost motion between the movement of the valve and the spindle, so that the valve may be sure to seat properly and the exhaust be properly timed. The crosshead receives a fork-ended connecting rod, whose ends are split and have a bolt forming a clip that grips the crosshead gudgeon, and it seems to me that it would have been better to have let the gudgeon be fast in the crosshead and put brasses in the forks of the connecting rods, thus increasing the bearing area, as Professor Sweet does in the straight line engine.

JOSHUA ROSE

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING. — John H. Smith, Julius F. Knuth, George Thompson, and Julius Ewald, Fairchild, Wis. A knuckle having a bifurcated inner end is pivoted to have a lateral movement upon the drawhead, a counterpoise trip lever being connected with the knuckle, with other novel features, making a coupler which can be coupled and uncoupled upon a curved as well as straight section, and with opposing drawheads of different heights.

ANTI-FRICTION BEARING.—William E. Ross, Sparta, N. J. This is a bearing specially designed for car axles, and also applicable to parts of machinery where a shaft or spindle is journaled, the axle having two or more sectors, combined with bearing blocks pivotally secured to a car hanger, and having curvilinear bearing faces, and a horizontally swinging lever engaging the bearing blocks.

SILL PLATE FOR CARS.—Ernest E. Jacobs, Arcola, Ill. This sill plate is provided with a roller along its upper front marginal portion, to freely rotate on bearings in a recessed part of the plate, to facilitate the loading and unloading of freight and prevent the sills from being damaged thereby, and without injuring or tearing the packages.

Electrical.

ELECTRIC DENTAL INSTRUMENT.—Fred Vernette, Hannibal, Mo. This is an instrument designed to remove the pain incident to the extraction of teeth, and consists of adjustable pivotally connected prongs carrying buttons and connected with an electrical battery, the buttons to be placed on the face over the nerves leading from the teeth to the brain, and a circuit established the moment the tooth-extracting instrument touches the tooth to be removed.

SAFETY FUSE FOR CONDUCTORS. — Walter S. Bishop, New Haven, Conn. This fuse is for preventing injury to instruments in telegraph and telephone circuits when the line wires are crossed with electric light wires, or when the line is struck by lightning, a thin strip of fusible metal being placed between the supports and protected by a plate of insulating material, such as mica, an incombustible non-conducting plate being also arranged between the fusible strip and the base piece of the safety fuse.

Mechanical.

MOULDING PLANE.—Edward D. Johnson, Flagstaff, Arizona Ter. This invention provides a single plane back or body adapted to receive and hold formers and moulding bits or knives of different form, whereby, with interchangeable sets of formers and bits or knives, it can be made to do the work of a great number of wooden planes heretofore employed to plane out mouldings by hand.

COMBINATION TOOL. — Alphonzo E. Meek, Dallas, Texas. This is a device comprising a spirit level, two bevels, an inclinometer, wire, iron, and thread gauges, scale of cuts and lengths of all the angles around the circle, and tables useful to those in the mechanic arts, being designed for architects, draughtsmen, millwrights and machinists, and all metal and wood workers, and being light and convenient to carry and readily adjustable in various positions.

FLOOR JACK. — William W. Irwin, Silver Lake, Oregon. This device consists of a tongs-like lever, the lower sections of which have clamping points, a rod or bolt passing through the lower sections, while a presser foot and a nail set are mounted on the rod or bolt, making an instrument designed to facilitate the adjustment and nailing of planks or boards to place in floorings, ceilings, etc.

Miscellaneous.

FLOUR CHEST.—Benjamin N. Rethey, Anna, Ill. This is a chest preferably divided into compartments for holding different kinds of flour, each compartment having a cover which can be turned into vertical position, while above the covers are compartments for holding salt, spices, etc., and brackets for supporting a rolling pin.

FEATHERING PADDLE WHEEL.—John Williamson, Brooklyn, N. Y. In this wheel blades are mounted to turn in a hub and arranged with gears to be engaged by racks, with means for reciprocating the racks, the device being designed for a submerged propeller, and the parts so arranged that the broad surfaces of the blades will be at right angles to the line of travel in forcing the vessel ahead, but when the blades would otherwise act, their side faces will be parallel with the path of the vessel.

METALLIC CARTRIDGE. — Abraham Martin, 177 Aston Lane, Witton, near Birmingham, Warwick County, England. The outer casing has a shoulder near its forward extremity, and an inner casing is upset in correspondence with the shoulder in the outer case, and has a closed base, the construction being adapted for cartridges for small arms and machine guns, and adapted to be filled with a solid or compressed explosive charge.

DENTAL DRILL ATTACHMENT. — Jesse H. Moyer and Jesse P. Stansell, Temple, Texas. Combined with the upper pulley and supporting pulley frame of the drill is a rod having hinged to its upper end a clip with set screw, and at its lower end a frame and wheel journaled, saving time and rendering it impossible for the cords to twist or become entangled when the hand piece is released.

CLIP FOR SILVER WARE CASES. — Henry and William Siebert, Bayonne, N. J. By this invention a supporting block is arranged for connection with the case, and U-shaped springs are bolted to the block, the free ends of the springs extending over the upper face of the block and toward each other, whereby articles having shanks of different widths may be retained in position.

AUTOMATIC CIGAR SELLING MACHINE. —Peter Schneider, Brooklyn, N. Y. This machine has a chute for the passage of a coin, and an electrical contact maker to be operated by the coin, a frame for holding vertically cigars resting on end on a traveling band, and a tripping device, whereby a cigar will be delivered by the operation of the mechanism.

CAP. — Herman Schwarz, New York City. This an improved article of head wear, having the material constituting the body extending in one continuous piece below the lower edge to form ear flaps, the extension being turned up within the crown when not in use, and having in its front portion a slit to the edges of which the stiffening of the visor is attached.

SAUSAGE STUFFER. — Frederick W. Wilder, Chicago, Ill. Combined with the outlet pipe of the machine, having a side opening, is a nozzle comprising a hollow cross mounted to turn on the outlet pipe, the arms of the cross registering alternately with the side opening, and a funnel held on each of the cross arms, the operation permitting of a rapid exchange of the nozzles carrying the casings to be filled without stopping the machine.

OYSTER OPENING IMPLEMENT.—George W. Thompson, Sag Harbor, N. Y. This device consists of two pivoted levers forming a handle and two pinchers-like jaws, with a knife or blade held detachably to one jaw, which has projections or teeth next the blade, whereby oysters and other shell fish may be opened quickly, easily, and in a cleanly manner.

FINGER GUARD.—Ernest H. Chesterton, Los Angeles, Cal. This is an implement for use in the slicing of vegetables, and consists of a metal pouch or guard into which two or more of the fingers are slipped, and a thumb pouch or guard connected to the main finger guard by a flexible band, the hand being thereby fully protected against possible cutting by the knife held in slicing.

DEVICE FOR COOLING MILK. — John W. Wagner, Darien, Wis. This improvement consists of a series of pipes placed parallel and connected at their ends by elbows, so as to form substantially a coil, to be placed in a tank or receptacle containing the milk to be cooled, when, by means of a flexible pipe, cold water is forced through the coil to cool the milk, the device being also adapted for heating when steam is forced through the coil.

SASH FASTENER. — Charles H. Miller and Samuel A. McDonald, Decatur, Texas. Combined with an angle bracket having an opening in its horizontal member wider at the top than the bottom is an essentially yoke-shaped bar passed through the opening, and a thumb lever hinged in the vertical member of the bracket, with other novel features, whereby a window may be locked in open or closed position.

BRAKE.—John N. Valley, Jersey City, N. J. This is a brake for wheeled vehicles, capable of operation lengthwise of the carriage, and positive in its action when applied, the carriage having a fixed abutment, beneath which is a wheel, while a conical brake shoe is arranged between them and slides lengthwise of the carriage.

THILL COUPLING JACK. — John H. Miller, Lewistown, Pa. This jack consists of a lever and a link bar having an adjustable connection therewith, in combination with a clamp, foot, and dog, the dog and clamp being connected to the end of the link bar upon a single axis, the device being designed to expedite and facilitate applying the thills to the axle clip against the pressure of the anti-rattler spring.

MEDICINE OR POSTAL SCALES. — William R. Watt, Somerville, Tenn. These scales are designed for use in connection with an inclosing case, which shall be of a size to be received in the pocket, the casing forming a bottom strip, to the inner side of which the standard is secured, whereby when the sides are swung outward the scale will be exposed in position for use.

TILE DITCHER. — Herman I. Potter, Leonardsburg, Ohio. This is an improvement on a formerly patented invention of the same inventor, the machine being designed to form ditches of a desired depth and width as it is drawn over the ground, and the invention covering a construction whereby the cost of manufacture is reduced and the machine is more readily controlled.

AMMONIA SODA APPARATUS.—Joseph P. Barnum, Louisville, Ky. This is an apparatus for the manufacture of bicarbonate of soda and other soda salts and compounds, and has an elevated salt water receiver and gasometer with stand pipe for the gas, a boiler and series of settling pans, an evaporating pan and cooler, with other novel features, the apparatus being more especially designed for use where natural gas, salt water, and limestone are found in close proximity.

COMPOUND TO PREVENT MORTAR FROM FREEZING. — Gustave Garrell, Baltimore, Md. This is a new composition of matter to be added to lime or cement mortars, and calculated also to greatly strengthen them, consisting of common salt, saltpeter, sulphate of iron, and coal ashes, or a described equivalent, mixed with and added to the mortar in certain proportions and after a manner described.

RENEWABLE MEMORANDUM BOOK. — Johann G. Bast, Brooklyn, N. Y. By this invention metallic strips are secured to the edges of the covers of a book at or adjacent to the flexible fabric connecting the covers, and having retaining grooves in to which the flanges on the back of a detachable book of leaves may be slid endwise and detachably held, whereby the covers may be readily attached or detached, and the book opened as wide as need be.

LAMP BURNER ATTACHMENT. — William Holmes, Ulster Park, N. Y. This attachment is stamped out of tin, sheet brass, or other suitable material, to form an upper bar and lower parallel bars adapted to reach nearly around the wick tube, forming a narrow space around the wick, by which the air is confined close to the wick and bottom of the blaze, to cause a better light than is produced by the common burner.

FIREMAN'S MASK.—Thomas E. Richet, Portland, Oregon. The body of the mask has a mouth opening and a pivoted shutter with two openings registering with the mouth opening, one of the openings fitted with porous material, sight openings covered with glass or mica, and a flexible pipe connected with the lower part of the mask which drops over the breast and down the inner side of the leg nearly to the floor, so that the air along the floor can pass up to the inside of the mask.

GAUGE KNIFE. — Charles F. Spery, Hermann, Mo. This is a knife for paring, slicing, and coring fruit, vegetables, and other articles, and has a concavo-convex blade, pointed at its outer end, with a slot formed intermediate of its edges, and with one portion bent out, forming an opening for the passage of the parings, the blade being readily fitted and firmly held to its handle.

HORSE COLLAR.—William Murr, Fountain City, Wis. The side sections of this horse collar have their upper ends adjustably connected together, a shield receiving the ends being provided with a flap, and having its edges united by a lacing strip, whereby the collar may be adjusted to fit almost any horse, and the hames will be held to place upon the collar.

WASHING MACHINE.—Hiram H. Gifford, Roscommon, Mich. The body of this machine has a perforated bottom, a cylinder being held beneath in which a piston is operated to cause a circulation of water through the clothes, to force the water in and draw it out under pressure and suction, thus effectually cleaning the articles without subjecting them to the wear of ordinary rubbing.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1248) Des Moines asks: How many ounces of No. 36 s. c. copper wire would be necessary to wind on a medical coil to produce a strong current, the spool being 3½ inches long? A. About 2 ounces. 2. Why should a short telegraph line work better after a rain, there being nothing but overhead wires used? A. Probably the rain improves the ground connection. 3. A firm in our city make a salammoniac battery, using a carbon cylinder with a zinc rod through the center; it works well for about a week, and then it weakens. Is it caused by polarization, and can I remedy it? A. We advise you to convert your cells into Leclanche batteries. 4. How can I make a prism such as are used in a prism Leclanche battery? A. The prisms are made from granulated black oxide of manganese and carbon cemented together by a small percentage of shellac. 5. What is the composition that is used on wood to give it the appearance of hard rubber? A. Wood is japanned to give it a hard black finish. 6. Which is the stronger—a Leclanche or the microphone cell that is made in St. Louis? A. We do not know of any report of comparative tests of the two batteries.

(1249) A. M. K. asks for a way to stain ivory black. I have been using nitrate of silver and pyrogallic acid, but it silvers the ivory, and what I would like to have is a dull black. How can I remedy the silvering, or is there any other stain which would be better? A. Boil in a strained decoction of logwood raspings, then immerse in a solution of sulphate of iron. Do not boil long or the ivory will crack all over. 2. How to render ivory flexible so that it can easily be bent. 2. Soak in a solution of phosphoric acid 1·130 sp. gravity until partly transparent. Wash carefully in water and dry between soft linen. On exposure to the air it becomes hard, but softens in warm water.

(1250) W. S. N. asks: 1. What chemicals must I use to form a paste which when dried will ignite by friction? A. Melt together on a water bath with great care the following: Red phosphorus 3 parts, gum tragacanth ½ part, water 3 parts, fine sand 2 parts, red lead 2 parts. 2. What chemicals are used in making parlor matches? A. For parlor matches first soak the dry sticks in melted stearine, then dip ends in above composition, and when dry into a solution of 4 parts gum benzoin in 10 of alcohol 40° B. 3. Where can I get a work on chemistry? A. We can supply any work desired by mail. We recommend Fownes' Chemistry. $3.25 in cloth, $3.75 in sheep.

(1251) H. R. H. S. asks (1) how to cut the thread in the amber mouthpiece of a pipe, and not, as with a common tap, chip or break the amber. A. By very slow and gentle application of heat amber can be slightly softened. While in this state a thread might be formed in it by compression. With proper tap or chaser a thread could easily be cut. 2. Can amber be dissolved and then again brought to its original form or state? A. No. It can only be softened as described. Warming in linseed oil has been used, but direct application of heat is now often employed. See query 1259.

(1252) F. S. asks for the process of condensing and canning milk. A. Some analyses and hints on subject mentioned may be found in our SUPPLEMENT, No. 320, which we can send you for 10 cents. Milk is condensed by evaporation in vacuo at a low temperature and with some sugar added and is canned in soldered cans. See for illustration of vacuum pan SCIENTIFIC AMERICAN of August 13, 1881.

(1253) K. H. asks: (1) What causes thunder? If produced by the air rushing in to fill the vacuum caused by the lightning, why is not the noise shrill? A cannon ball makes a high sound, and electricity travels much faster and occupies less space than that. A. The cause of thunder is in some respects still a mystery. We know that the electric discharge is accompanied by noise, which however is not referred to any vacuum. An attempt has been made to account for some of its peculiarities by assuming echoes to be produced, but this is hardly satisfactory. 2. Is smoking a pipe in moderation injurious to the system, provided one keeps it clean and clear of nicotine, uses good tobacco and does not inhale the smoke? A. We think not in all cases. It affects the heart, and if that is sound little is to be apprehended from it used in moderation.

(1254) K. B. asks for a recipe for a cherry stain and polish and how to apply them to get the same finish as in furniture. A. Boil ½ pound madder and 2 ounces logwood chips in 1 gallon water, brush over wood while hot, when dry go over it with solution of 1 ounce pearlash in 1 gallon water. The finish may be produced by ordinary methods, sandpapering followed by ground pumice and water, and varnish. We recommend the French Polisher's Manual, which we can supply for 20 cents.

(1255) C. N. F. asks for (1) a cheap but good recipe for making canvas and duck waterproof. A. Melt in paraffin with a hot iron so as to impregnate the material thoroughly. 2. What will take mildew out of white duck window awnings? A. Treat the awnings with thin fresh whitewash. It will cover, not remove, the mildew. 3. What are the best means to capture wild birds without injuring them in any way? A. Use a large sized cage trap. Even then the bird will be apt to injure itself by its efforts to escape.

(1256) C. D. A. asks whether any sheet gum is manufactured in thickness of ⅛ or ⅜ inch, that cut in pieces of 8 inches square would resist a pressure of 100 tons and still be elastic, and return to itself again when relieved of aforesaid pressure. A. We think a good quality of India rubber would support the strain if properly supported and re-enforced.

(1257) F. P. writes: At various times in various papers, I have seen recipes for soap bubble fluid. I have tried all I have seen and heard of, like glycerine, mucilage, etc., but find no improvement on white Castile soap suds. Can you give anything that will improve the situation? A. There is much difficulty in obtaining a really good soap bubble mixture. Marseilles soap is considered excellent, and oleate of soda is often recommended, glycerine of highest purity being used in most cases as an addition. We refer you to SCIENTIFIC AMERICAN SUPPLEMENT, No. 435, for several formulæ.

(1258) Reader asks how sound is transmitted by the telephone. Are sound waves converted into electric or magnetic currents, or does the vibration travel through the wire? A. The sound waves cause the plate in front of the magnet to vibrate. This produces electric currents, which pass through the wire and act upon the receiving telephone to produce similar vibrations in the plate in front of its poles. These similar vibrations produce a similar sound. The same applies in general to a microphone and other systems. In the microphone, for instance, a contact is disturbed, changing the intensity of a constantly passing current, which changes react upon the distant receiver.

(1259) C. F. writes: I have a valuable amber mouthpiece which was accidentally broken in two but not splintered. Would be greatly obliged if you could give, through Notes and Queries, a recipe for a cement or other method by which the broken parts could be united strongly, and, at the same time, be proof against heat and the effects of "tobacco oil" and nicotine. A. Smear the parts to be joined with linseed oil, wrap the parts in paper separately, place in position and heat the junction only very carefully over a gas burner. As it softens a little press together, and holding very steadily remove from heat and allow to cool. As is evident, it should be done by an expert, as there is great danger of applying too much or too little heat.

(1260) E. E. M. asks how to make a white ink to use with rubber stamps to put the size mark on black stockings, not necessarily indelible. A. Use Chinese white rubbed up with water and ten per cent gum arabic. A little glycerine may be added.

(1261) A. B. asks: 1. Is electrical welding done by arc action? A. Electric welding has been done by means of the arc, but it is generally done by the direct heating action of the current. 2. If two electromagnets, each of which will sustain twenty-five pounds, are brought in contact with unlike poles, would it take more than a 50 pound weight to separate them? A. No. For full information on electro-magnets consult Hering's or DuMoncel's work on the subject. Prices respectively $2.50 and 75 cents.

(1262) H. D. C. writes: It is said that there is no known insulator of magnetism. What effect then has the brass regulating tube of an induction coil on the strength of the current? A. It absorbs the force developed by changes in intensity or direction of magnetic currents. It acts practically as an insulator of inductive action.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

August 20, 1889,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Ammonia soda apparatus, J. P. Barnum 409,382
Anchor tripper, C. W. Delon 409,176
Animal trap, H. E. Kelley 409,467, 409,468
Animal trap, Z. B. Kidder 409,502
Animal trap, L. N. Loomis 409,212
Animal trap, A. Worden 409,381
Animals by electricity, apparatus for treating, G. M. Lawrence 409,470
Armature core for dynamos, D. Higham 409,463
Axle lubricator, H. M. Goodman 409,573
Axle, vehicle, J. G. Kenyon 409,362
Bag. See Paper bag.
Baling press, J. Price 409,335
Ball and socket joint for steam pipe connections, T. Curley 409,277
Band cutter and feeder, H. L. Earle 409,461
Bar. See Clothes bar.
Barrel heater, J. Rath 409,301
Barrel hoop, G. W. Parrish 409,228
Barrel, metallic, C. J. Curtin 409,601
Basket, I. H. Speiman 409,432
Bath. See Photographic developing bath.
Bathtubs, attachment seat for, G. W. Myers 409,645
Batteries, making solution compounds for galvanic, W. P. Kookogey 409,291
Battery. See Galvanic battery. Gas battery. Secondary battery.
Bearing, anti-friction, W. E. Ross 409,430
Bearing for fifth wheels, perch, W. H. Cooper 409,561
Bed, folding, Van Hoorebeke & Ford 409,527
Bed, folding cot, G. H. Wilson 409,262
Bedstead, folding, H. S. Hale 409,606
Belt fastener, J. Snow 409,252
Bench clamp, G. A. Loring 409,295
Bevel, protractor, gauge, center square, etc., combined, A. E. Meek 409,414
Blacking box, liquid, Metzler & Davis 409,415
Block. See Sawmill head block.
Board. See Game board. Ironing board.
Boiler. See Steam boiler.
Boiler attachment, steam, L. F. Smith 409,617
Boiler furnace or other furnace, steam, W. R. Roney 409,304
Boiler setting, Balmore & Rockwell 409,552
Boilers, high and low water alarm for steam, A. W. Gilfillan 409,189
Bolt. See Rotary bolt.
Bolt heading machines, tongs and guide for, J. H. Alker 409,595
Bolt pointing machine, F. R. Scofield 409,244
Bone grinding machine, Mann & Farrington 409,480
Bookkeepers, posting or copying guide for, H. H. Love 409,363
Book, renewable memorandum, J. G. Bast 409,388
Boot or shoe riveting machine, T. Brining 409,347
Bottle cooler, L. Levy 409,292
Bottle stopper, J. J. Sands 409,374
Box. See Blacking box. Folding box. Journal box.
Brace. See Trestle brace.
Bracket. See Fence bracket.
Brake. See Car brake. Railway brake.
Brick machine, W. R. Cunningham 409,348
Brick machine, Kirk & Horton 409,593
Bridge gate, C. King 409,407
Brine, apparatus for making and filtering, B. B. Quinn 409,334
Burner. See Gas burner. Lamp burner. Oil burner. Sawdust burner. Vapor burner.
Butter package, S. Crittenden 409,318
Button making machine, P. A. Otis 409,225
Caisson, F. Girein 409,190
Calendar, F. M. Underhill 409,526
Can. See Spouted can.
Can, H. E. Wright 409,264
Canner, steam fruit, T. P. Cordrey 409,274
Car brake, A. P. Massey 409,328
Car brake, W. R. Zeigler 409,206
Car coupling, Allen & Hackett 409,345
Car coupling, N. Newman 409,430
Car coupling, A. Paul 409,229
Car coupling, J. H. Smith *et al.* 409,431
Car door, street, S. R. Owen 409,432
Car, dumping, J. Duff 409,594, 409,395
Car heating apparatus, I. T. Dyer 409,278
Car heating apparatus, J. E. Sague 409,306
Car seat, J. T. Westwood 409,654
Car wheel, W. M. Morgan 409,219
Cars, apparatus for operating cable, J. Williams, Jr. 409,622
Cars, buffer brake for railways, H. S. Richards, (r) 11,026
Cars, gangway for loading or unloading stock, J. W. & J. N. McIver 409,222
Cars, safety guard for street, M. J. Goodwin 409,192
Cars, sand box for railway, E. W. Davis 409,602
Cars, sill plate for railway, E. E. Jacobs 409,404
Carbons, kiln for the manufacture of, P. P. Nungesser 409,489
Carbons, manufacturing, P. P. Nungesser 409,490
Carburetor, J. Elder 409,570
Carding engine flats, apparatus for controlling the grinding of, J. M. Hetherington 409,462
Carding engines, condensing mechanism for, G. Layng 409,211
Carpet stretcher, H. McCormack 409,647
Carriages, parasol for baby, G. W. Travers 409,435
Carrier. See Hay carrier.
Cart, coal, M. Toulmin 409,620
Carts, seat back for road, J. D. Hough 409,402
Case. See Piano case.
Cash indicator and register, C. H. Kahler 409,306
Caster, O. Pederson 409,498
Casting, mould for, E. C. Standiford 409,519
Chairs or analogous articles of furniture, guard for rocking, A. F. Baumann 409,444
Chart for draughting garments, H. P. Fike 409,184
Chuck, pulley, W. J. Muncaster 409,183
Churn, W. Walter 409,533
Cigar bunching machine, F. A. Grab 409,575
Clamp. See Bench clamp.
Clamping plate for timber structures, G. W. Zeigler .... 409,546 to 409,548
Clasp. See Corset clasp.
Clay, machine for separating gravel from, S. Friend 409,186
Clay, separating gravel from, S. Friend 409,187
Closet. See Siphon closet.
Clothes bar, revolving, J. E. Armson 409,442
Clothes drier, W. H. Little 409,642
Clothes line attachment, H. Maeurer 409,327
Clutch, friction, Hill & Hirt 409,586
Coal, conveyer for piling, J. M. Dodge 409,604
Coal or analogous material, piling, J. M. Dodge 409,636
Coal, removing piles of, J. M. Dodge 409,568
Cock, gauge, A. Worthington 409,263
Cock or valve, J. Powell 409,334
Coffin fastener, Van Horn & Lathe 409,436
Coke, apparatus for the manufacture of, R. De Soldenhoff 409,567
Collar, horse, W. Murr 409,418
Collars, making apparel, J. F. Fellows 409,179
Comb. See Curry comb.
Commode, T. C. Joyce 409,500
Composing stick, V. Sperle 409,518
Concrete, etc., machine for making, Carey & Latham 409,560
Conveyer, G. W. McCaslin 409,330, 409,612
Conveyer, sectional screw, W. H. Cornell 409,454
Cooler. See Bottle cooler.
Corset clasp, J. M. V. LeBeau 409,410
Coupling. See Car coupling. Hose coupling. Pipe coupling.
Cover for vessels, self-adjusting, S. F. Green 409,354
Cradle, J. H. Wiggers 409,260
Crate, folding, J. W. Brook 409,386
Crosshead, L. H. Kenyon 409,290
Crossing and switch, combined, F. C. Weir 409,537, 409,538
Crozing machine, L. M. Reed 409,235
Cultivator, A. Ellis 409,605
Cup. See Oil cup.
Curb, pavement, I. L. Landis 409,469
Curry comb, L. M. Devore 409,458
Curry combs, machine for riveting, M. Sweet 409,522
Cutter. See Band cutter.
Cutter, pulverizer, drag, and roller, combined, A. J. Casey 409,391
Damper for boiler furnaces, automatic, F. E. Shank 409,247
Damper, stovepipe, L. M. Devore 409,459
Dental instrument, electric, F. Vernette 409,437
Die bearing disk, M. M. Shellaberger 409,309
Digger. See Potato digger.
Distributer for cards or other articles, automatic, W. Fischer 409,571
Ditcher, tile, H. I. Potter 409,424
Door check, L. W. Hardy 409,194
Door spring, F. W. Hoefer 409,587
Draught equalizer, C. W. Phelps 409,497
Drapery trimming, P. Gumbinner 409,400
Dress, shield, Crandal & Reeme 409,173
Drier. See Clothes drier. Grain drier.
Drier, J. B. Johnson 409,359
Drills, apparatus for operating rotary, M. T. Chapman 409,272
Drying fabrics, machine for, I. E. Palmer 409,615
Drying frame for knitted drawers, Clemins & Tice 409,630
Dust collector, N. W. Holt 409,465
Dust collector, O. M. Morse 409,482
Dye, compound, C. S. Bedford 409,384
Dynamos, brush holder for, J. M. McClellan 409,646
Egg beater, J. Richardson 409,616
Electric conductors, safety flue for, W. S. Bishop 409,628
Electric machine, dynamo, S. Z. De Ferranti 409,349
Electric main joint, S. Z. De Ferranti 409,183
Electrical distribution, system of, C. S. Bradley 409,449, 409,450
Electrical energy, distribution of, S. Z. De Ferranti 409,182, 409,565, 409,566
Electrical indicator, E. R. Knowles 409,207
Electrical lock, P. Schwenke 409,508
Electricity, conductor for conveying, S. Z. De Ferranti 409,181
Elevator. See Hay elevator.
Elevators, safety cushion for, W. E. Nickerson 409,486, 409,487
End gate, wagon, S. J. Mason 409,413
Engine. See Rotary engine. Steam engine.
Engines, bed plate for steam, M. Hastings 409,198
Envelope machine, J. Ball 409,624
Evaporating liquids, apparatus for, T. Gaunt 409,572
Exhibitor, C. H. Bacon 409,160
Exhibitor for wall paper or other goods, H. Michaels 409,218
Explosive, nitro-gelatine, Abel & Dewar 409,549
Extractor. See Nail extractor.
Eye bars, die for making, J. F. Kingsley (r) 11,025
Fabric. See Knitted fabric.
Feed regulator, J. A. McAnulty 409,329
Feeder, automatic, C. N. McFarland 409,331
Feeding stock, device for, G. Black 409,162
Felt for hats, etc., treating fur or wool, T. Sealy 409,651
Fence, W. V. Russell 409,243
Fence bracket, A. O. Corell 409,172
Fence machine, wire, L. C. Lowden 409,477
Fence post, F. L. Fairchild 409,396
Fence, wire, T. I. Rushton 409,242
Fertilizers, making, C. C. Peck 409,230
File, document, R. S. Rich 409,236
Filter, Clayton & Holdroyd 409,273
Filter, P. Laughlin 409,210
Filter system, J. J. Murphy 409,611
Firearm, magazine, J. M. & M. S. Browning 409,599, 409,600
Fire escape, J. Slough 409,511
Fire extinguisher, S. H. Timmons 409,312
Fireman's mask, T. E. Richet 409,428
Floor jack, W. W. Irwin 409,403
Fluid releaser, automatic electrical, B. S. Molyneux 409,364
Folding box or crate, J. C. & W. L. Thompson 409,523
Fork. See Hay fork.
Frame. See Drying frame.
Frog, spring, F. C. Weir 409,539
Fruit picker, J. B. Marshall 409,296
Furnace. See Boiler furnace. Petroleum furnace. Smelting furnace.
Furnace, W. R. Roney 409,650
Furnace grate, W. R. Roney 409,305
Gauge glass tubes, device for protecting, E. Engels 409,280
Gauge knife, W. E. Brock 409,629
Gauge knife, C. F. Spery 409,438
Galvanic battery, G. C. Ward 409,289
Game board, J. Snell 409,251
Gas and electric light fixture, combined, T. J. Pierce 409,498
Gas batteries, obtaining electricity from, Mond & Langer 409,366
Gas battery, Mond & Langer 409,365
Gas burner, incandescent, J. L. Stewart 409,520
Gas burners, making incandescing elements for, C. B. Harris 409,697
Gas fitting, G. H. Gregory 409,577
Gas furnaces, burner carriage for, H. J. Bell 409,625
Gas incandescent, C. A. Von Welsbach 409,528
Gas incandescents, manufacture of, C. A. Von Welsbach 409,531
Gas meter, J. W. Culmer 409,275
Gas pressure indicator, R. L. Simons 409,375
Gases, apparatus for treating solids with, C. Langer 409,409
Gate. See Bridge gate. End gate. Railway gate.
Gate, M. W. Forster 409,185
Glass melting pot, A. G. Neville 409,308
Grain and seed separator, N. J. Vinyard 409,256
Grain, device for separating weevil and weevil dust from, Ferguson & Blanchard 409,180
Grain drier, G. H. Immendorf 409,287
Grinding sheaves, etc., machine for, H. C. Stifel 409,254
Gun barrels, means for attaching fore-end stocks to, J. E. Gage 409,188
Gun, magazine, S. H. Roper 409,429
Hame attachment, A. B. Rowell 409,505
Hand rake, J. Paxson 409,494
Hanger. See Picture hanger.
Harrow, C. L. Powell 409,233
Harrow attachment, disk, S. Ritte 409,298
Harvester, corn, J. Armstrong 409,443
Harvesters, elevator attachment for, M. B. Stambaugh 409,377
Hat, padded, J. H. Moyer 409,417
Hay carrier, A. P. Boyer 409,164
Hay elevator, W. Rodham 409,303
Hay fork, S. K. Lucky 409,478
Head rest, J. W. Campbell 409,369
Heater. See Barrel heater. Soldering iron heater. Water heater.
Heel nailing machine, C. W. Glidden 409,637
Heel nailing machine, F. F. Raymond, 2d 409,372
Hinge, spring, J. W. Pierce 409,371
Hoisting apparatus, J. H. Montgomery 409,656
Holder. See Key holder. Sack holder. Window holder. Work holder.
Hook. See Suspension hook. Whiffletree hook.
Hoop. See Barrel hoop. Truss hoop.
Hoop driving machine, G. W. Packer 409,297
Horse blanket, J. L. Coburn 409,392
Horse blanket, J. E. Foster 409,352
Horses' feet, poultice or sponge holder for, C. P. Dacey 409,643
Hose coupling, C. L. Smith 409,512
House. See Smoke house.
Indicator. See Cash indicator. Electrical indicator. Gas pressure indicator. Time and wage indicator.
Indicator to prevent overflow of liquids in closed vessels, W. S. Stuyvesant 409,339
Inkstand, G. A. Fifield 409,351
Ironing board, J. D. Smith 409,515
Ironing table and step ladder, S. L. Strong 409,521
Jack. See Floor jack.
Jar. See Self-sealing jar.
Joint. See Ball and socket joint. Electric main joint. Pipe joint.
Journal box, anti-friction, W. S. Sharpneck 409,307
Journal boxes, cage for, W. S. Sharpneck 409,308
Key holder, C. E. Van Norman 409,255
Knife. See Gauge knife.
Knitted fabric, H. Pulster 409,426
Lamp, T. Gordon 409,353
Lamp, arc, R. D. Carson 409,390
Lamp burner, W. Notley 409,614
Lamp burner attachment, W. Holmes 409,401
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Lamp standard, O. Luetke 409,214
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Lantern, A. M. Schilling 409,506
Lantern, signal, J. Wall 409,532
Last, E. W. Arnold 409,551
Lathes, feeding mechanism for, H. M. Darling 409,456
Lathes, tool post for, J. A. Myers 409,484
Leaf turner, T. J. Parkinson 409,370
Leather and preparing the same, chrome tanned, L. Rappe 409,336
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Lock. See Electrical lock. Nut lock. Permutation lock. Time lock.
Locks, rose for, A. A. Severance 409,246
Log conveyer, E. S. Jones 409,361
Loom for weaving tufted fabrics, etc., W. Adams 409,550
Loom picker staff check, Hall & Young 409,580
Loom shuttle, C. G. Petzold 409,232
Loom shuttle supplying mechanism, Evans & Shay 409,262
Loom temple, J. B. Newell 409,369
Lubricator. See Axle lubricator.
Mantel, W. Anderson 409,596
Mantles for incandescent uses, regenerating, C. A. Von Welsbach 409,529
Match box filling machine, slide, J. D. Mantion *et al.* 409,481
Mechanical movement, W. W. Griscom 409,193
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Metal wheel, J. R. Little 409,475
Metals while in a heated condition, preventing the oxidation of, Cummins & Coleman 409,276
Meter. See Gas meter.
Mill. See Pulverizing mill. Saw mill.
Miter machine, J. J. Cowell 409,455
Moulding machine, sand, F. G. Leeder 409,471
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Potato digger, J. A. Lewis ... 409,293
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Press. See Baling press.
Pressure regulator, M. Hastings ... 409,300
Pressure regulator, gas, H. J. Bell ... 409,626, 409,627
Printing pyroxyline compounds, C. F. Brady ... 409,345
Pulley, split, M. O. Reeves ... 409,427
Pulley, wooden, M. O. Reeves ... 409,426
Pulverizing mill, J. K. Griffin ... 409,579
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Pump governor, J. T. Pine ... 409,500
Punch, check, F. J. Lockwood ... 409,294
Railway brake, A. Watson ... 409,536
Railway gate, R. C. Douglass ... 409,177
Railway, pneumatic, W. L. Judson ... 409,306
Railway signal, R. W. Norwood ... 409,648
Railway switches, safety attachment for, Brown & Gough ... 409,168
Railway switches, safety lock and shackle for, W. H. Caine ... 409,386
Railway system, electrical, E. E. Ries ... 409,237
Railways, applying sand to rails of, J. Gresham ... 409,578
Railways, automatic switch for horse, Binns & Wolff ... 409,366
Railways, trolley for electric, J. G. Dickson et al ... 409,603
Rake. See Hand rake.
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Revolving signal, Warren & Radford ... 409,334
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Rock for paving, roofing, and building purposes, bituminous sand, Patterson & Groat ... 409,493
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Rotary engine, T. E. Keavy ... 409,591
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Saddle, riding, S. Hainkel ... 409,324
Sash balance, L. W. Doren ... 409,569
Sash balance, N. J. Skaggs ... 409,376
Sash lift, G. Hasenpflug ... 409,582
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Scales, weighing, R. E. Glover ... 409,191
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Screw blanks, machine for dressing the ends of, G. E. Witherell ... 409,441
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Seat. See Car seat. Vehicle seat.
Secondary battery, C. S. Bradley ... 409,448
Secondary battery, C. A. Faure ... 409,178
Self-sealing jar, J. W. Bulger ... 409,169
Separator. See Grain and seed separator. Powder separator.
Sewing machine, shoe, A. Eppler, Jr ... 409,281
Sewing machine, sole, J. E. Bertrand ... 409,161
Shaft supporter, vehicle, H. F. Welch ... 409,621
Sheet metal pipe, C. L. Hart ... 409,196
Shingle, sheet metal, Brown & Thorn ... 409,387
Shoe burnishing machine, S. Rose, Jr ... 409,240
Shutter fastener, L. Whitehouse ... 409,438
Shutter worker, R. W. Jorres ... 409,406
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Signal. See Railway signal. Revolving signal.
Signaling apparatus, nautical, T. Smith ... 409,250
Siphon closet, H. C. Weeden ... 409,341
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Steam engine, J. Curtis ... 409,563
Steam engine, Dennis & Shoemaker ... 409,457
Steam engine, M. W. Hall ... 409,284
Stirrup, J. Bull ... 409,556
Stone grinding and polishing machine, J. McEnerney ... 409,419
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Suspension hook, L. F. Roller ... 409,239
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Table. See Ironing table.
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Toy, G. W. Nusbaum ... 409,521
Toy, automatic, F. Noecker ... 409,488
Trace, A. W. Bricken ... 409,166
Trap. See Animal trap.
Trestle, G. W. Zeigler ... 409,544
Trestle brace, G. W. Zeigler ... 409,543
Trimming for fabrics, J. D. Morley ... 409,416
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Truss hoop, L. Roth ... 409,241
Tubing, single ply spiral, E. K. Coas ... 409,171
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Ventilator, B. M. Turnbull ... 409,535
Vermifuge, W. Dawson ... 409,175
Vessels, raising sunken, J. Wanner ... 409,287
Wagon, lumber, W. & J. H. Leonhardt ... 409,411
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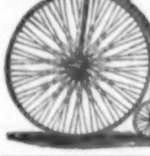

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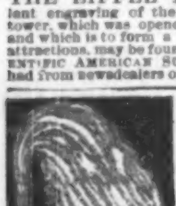

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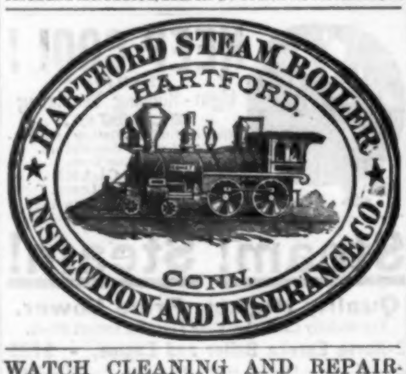

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